
2a


1


2c


13


2b


4a


3


4b


12


5b


5a


5c


6


11a


7b


7a


7c


8b


10


8a


9a


9d


11b


9b


9c

A. J. Engel Terzi, del.

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SKULLS OF RHINOLOPHI.

14c

14a

14b

16b

15

14d

16c

19a

17b

16a

17c

18c

18b

20a

17a

19c

20d

19b

20b

18a

20c

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SKULLS OF RHINOLOPHI.

3. On some Bats of the Genus *Rhinolophus*, with Remarks on their Mutual Affinities, and Descriptions of Twenty-six new Forms. By Knud Andersen *.

[Received May 12, 1905.]

(Plates III. & IV.† and Text-figure 22.)

The present paper is, chiefly, an attempt to disentangle some of the more complicated groups of Eastern *Rhinolophi*, to make out the probable interrelations of the species, and to describe the many new, imperfectly known, or hitherto confused forms. I have appended some general remarks on the affinities of the Ethiopian and Western Palæarctic species.

The material placed at my disposal has been more extensive than that of previous writers on these Bats, namely, Prof. Peters (1871) and Dr. Dobson (1878); and I have approached the subject from a different point of view, basing the diagnoses of the primary groups, and, where possible, of the species and subspecies too, not on external and dental characters alone, but also on important differences in the skulls. This may account, partly at least, for the essentially different conclusions on many points at which I have arrived. On the other hand, the following pages afford ample proof that my material has not been complete enough to enable me to venture an answer on all the difficult questions, taxonomic or phylogenetic, that occurred to me during my work. I shall feel satisfied if my paper is considered of some use as a basis for further investigations.

I owe my sincere thanks to Mr. Oldfield Thomas for entrusting me with a revision of these Bats, for giving me unlimited access to the recently acquired, still unregistered specimens in the British Museum, especially those of the large and important "Tomes Collection," and also for having favoured me with much valuable information during the progress of my work.

I also have to acknowledge the kind assistance of Mr. Gerrit S. Miller, Jr., who sent me for inspection almost all the Indo-Malayan *Rhinolophi* preserved in the United States National Museum, including many new and interesting forms, part of which will be dealt with below.

For the loan of specimens for comparison, or for information on examples preserved in Continental Museums, I am indebted to Geheimrath Prof. Dr. Ehlers, Göttingen; Prof. Matschie, Berlin; Prof. Dr. Kurt Lampert, Stuttgart; M. Ch. Mottaz, Geneva; M. A. Ménégaux, Paris; and Prof. A. Cabrera Latorre, Madrid.

I. The *Rhinolophus simplex* Group.

Diagnosis. Basioccipital, between cochleæ, not unusually narrowed. Posterior connecting process low and rounded off (text-fig. 22 *a*, on p. 121).

* Communicated by Oldfield Thomas, F.Z.S.

† For explanation of the Plates, see p. 145.

I include in this group 40 different forms (22 species), corresponding to *Rh. megaphyllus*, *affinis*, *capensis*, *clivosus*, and *ferrum-equinum* in Dobson's 'Catalogue of the Chiroptera in the British Museum.' Only the Austro-Malayan, Oriental, and Palæarctic forms will be described below, and only the first species in some detail, the description of the other forms being, as a rule, confined to the points in which they differ from the fundamental type. The Ethiopian species will be briefly mentioned in the "General Remarks" on the group (p. 117).

1. Rhinolophus simplex, sp. n. (Plate III. fig. 1.)

Diagnosis. Cranial character: supraorbital crests meeting at a point behind the middle of the orbit. External: sella distinctly constricted at middle. Forearm 44·2 mm.

Details. Nose-leaves large, as compared with those of the other Austro-Malayan species (*Rh. truncatus*, *nanus*). A supplementary leaflet distinctly visible in front of, and on the anterior part of the sides of, the horseshoe; a character common to all the members of the present group, but becoming gradually less pronounced in the more highly developed species (*affinis*, *ferrum-equinum*, and their allies); it seems to point back to the much more primitive genus *Hipposiderus*. Horseshoe so broad as to completely cover the upper lip; a slight indication of a tooth-like projection on either side of the median notch. Sella decidedly broader at base than at summit, and distinctly constricted at middle; summit rounded; height of sella, from angle between vertical portion and nasal lobe, about 4·8 mm., width at base 2·3, at constriction 1·9, at summit 1·8 mm.; front of sella densely covered with exceedingly short white hairs (scarcely observable without a lens). Posterior connecting process low and broadly rounded off. Lancet long, almost cuneate; length, from posterior transverse bridge, about 4·7 mm. Three mental grooves, as in all forms of this group, except the highest-differentiated species (*ferrum-equinum* and its nearest relations).

Ears, compared with those of the closely allied Austro-Malayan species, rather large, almost reaching the tip of the muzzle when laid forwards. Upper part of outer margin somewhat concave; tip blunt; no constriction below the tip.

Wing-structure very primitive: 4th and 5th metacarpals subequal in length (the 5th, if anything, a little shorter), and both of them but very slightly longer than 3rd; III.^{2}* less than $1\frac{1}{2}$ the length of III.^{1}; IV.^{2} and, especially, V.^{2} very short, being only a trifle longer than IV.^{1} and V.^{1} This structure of the wing is characteristic of *all* the primitive members of this group (*simplex*, *megaphyllus*, *truncatus*, *nanus*, *celebensis*, *borneensis*, *malayanus*, *rouxi*, &c.); it is first in so highly-developed forms as *affinis* and its various modifications (*ferrum-equinum*, &c.) that we find an important progress: prolongation of III.^{2}; shortening of the 3rd

* For brevity's sake I call the proximal phalanges of the 3rd, 4th, and 5th fingers III.^{1}, IV.^{1}, and V.^{1}, the distal phalanges of the same fingers III.^{2}, IV.^{2}, and V.^{2}

metacarpal, as compared with the 4th and 5th; the 5th metacarpal decidedly longer than the 4th; &c.

Tail a little longer than the lower leg. Plagiopatagium inserted on tarsus.

Colour (of a spirit-specimen, unfaded). Fur of upper side a very dark shade of "drab," approaching "Prout's brown"; base of hairs rather more distinctly drab; under side somewhat darker than drab.

Skull. Four anterior nasal swellings and two posterior. The four anterior arranged in a transverse row, forming the upper and lateral borders of the nasal opening. Externally these anterior swellings are separated only by extremely faint linear depressions; internally by three bony lamellæ, also easily observable through the thin, transparent outer wall of the swellings. The posterior nasal swellings, situated immediately behind the anterior ones, at the front corner of the orbital cavity, are much lower, slightly concave at summit; three very faint lines divide them, rather indistinctly, into an upper, middle, and lower swelling.—The shape and arrangement of the nasal swellings, as here described, are, roughly speaking, the same in almost all the members of the *simplex*-group; there is some variation in the size of the swellings in the different species; but the more noteworthy deviations from the general scheme are two only: *Rh. malayanus* and *Rh. stheno*.

Postnasal depression triangular in shape, rather long; the supraorbital crests, which constitute the lateral border of this depression, meeting (and joining the sagittal crest) at a point more or less *behind* the middle of the orbital cavity. "Supraorbital length" of skull (*i. e.* distance between the point of junction of supraorbital crests and median anterior point of nasal swellings) greater than extreme width of nasal swellings.—The shape of this part of the skull, as here described, is characteristic of only the four most primitive members of the group (*simplex*, *megaphyllus*, *truncatus*, *nanus*).

Palatal bridge comparatively long (in antero-posterior direction); measured in the median line equal to about one-third the length of the upper tooth-row; median anterior point opposite the front of m^1, median posterior point opposite the middle of m^2.

Dentition. As a general guidance: in all existing species of the genus the upper p^3 * is completely lost; in all the more primitive

* I write the dental formula (excl. of incisors and canines) of a *Rhinolophus* with the most complete known dentition as follows: $\frac{p^2 \quad p^4 \; m^1 \; m^2 \; m^3}{p_2 \; p_3 \; p_4 \; m_1 \; m_2 \; m_3}$ (*cf.* Herluf Winge, "Jordfundne og nulevende Flagermus fra Lagoa Santa; med Udsigt over Flagermusenes indbyrdes Slægtskab"; E Museo Lundii, vol. ii. pt. 1 (1892), p. 56). As already mentioned by Winge, we have no *positive proof* whether the upper premolar lost in all known species is p^3 or p^2. For two reasons I regard the former alternative to be the more probable:—(1) In all *Rhinolophi*, also the most primitive forms, the lower p_3 is *on the point of being reduced*, in the more highly-developed species pushed definitely out to the external side of the tooth-row, in the still higher forms completely lost; it is but reasonable to suppose that the premolar *quite lost* in the upper jaw of *all* species corresponds to the premolar which is *on the point of being lost* in the lower jaw of *all* species, in consonance with the general rule that the teeth of the upper jaw show a *more advanced stage* of evolution than those

species of the *simplex*-group also the lower p_3 is very much reduced in size and *on the point of* being driven out of the tooth-row, to the external side; in all the more primitive species of the group also the upper p^2 is reduced in size, but still, *invariably*, in the tooth-row.

The following remarks apply to *Rh. simplex* and *Rh. megaphyllus*, the dentition of these two species, the most primitive within the present group, being practically exactly alike:—p_3 very small, but decidedly less reduced than in the other species of the group. The position of this tooth, in relation to p_2 and p_4, varies *individually* (in the same geographical race, and in examples from the same locality and of apparently the same age): completely in the tooth-row (one specimen), or slightly towards the external side (two), or half external (one), or almost quite external (one), or completely external (one). This "vacillation" in the position of p_3 is of some interest as being the first indication of a tendency towards driving this premolar out of the tooth-row, a tendency gradually increasing in a long series of more highly developed species, and culminating in the forms in which the tooth is quite lost, even in young individuals (*Rh. acrotis*).—p^2 is comparatively large, with a well-developed, pointed cusp. From its base to its tip this cusp is directed *obliquely inwards*, under an angle of about 25° to 45° with the vertical line; also in those species of the present group in which the cusp is so much reduced as to be scarcely perceptible without a lens, it is invariably pointing obliquely inwards, only to a still higher degree. The upper canine and p^4 always *widely* separated. In some individuals there is a very narrow interspace between p^2 and p^4, on either side of the jaw, or on one side, no doubt a remnant of the place where p^3, lost in all existing species, was situated (see footnote on p. 77).

Measurements *. On p. 80.

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of the lower jaw. (2) When the lower p_3 is external in position, or *even when it is completely lost*, we still, rather often, find p_2 and p_4 separated by a narrow interspace, reminiscent of the time when p_3 had its normal position in the tooth-row; if we can find, sometimes at least, a similar "atavism" in the upper jaw, our supposition will be strengthened; and such cases are, in fact, not very rare:—in some individuals, and just those of the most primitive species of the genus (*simplex, megaphyllus, borneensis, refulgens, philippinensis*), I find an arrangement of the upper teeth which can be graphically expressed as follows: cp $pm^1m^2m^3$, *i.e.* the anterior of the upper premolars in contact with the canine, the posterior in contact with the first molar, but *between the two "p" still a narrow interspace*, apparently a remnant of the place where the lost premolar was situated; if so, however, the lost p is, of course, p^3, those present p^2 and p^4.

* Only the following measurements require some explanation:—*Ears*, length from base of inner margin to tip. *Forearm*, from posterior point of radius to front curve of carpus (wing bent), therefore somewhat greater than the length of radius measured on skeletons. *Metacarpals*, as far as possible the true length of the bones. *2nd phalanx*, always *exclusive of the* cartilaginous "*3rd phalanx*" (this restriction being of especial importance in measurements of the 3rd finger, the terminal cartilaginous rod of which is comparatively large). *Hind foot*, with claws. *Skull, total length*, to front of *canines* (not to front of premaxilla). *Width of brain-case*, above root of zygomata. *Supraorbital length*, distance between point of junction of supraorbital crests with sagittal crest and median anterior point of nasal swellings. *Mandible*, condylus to front of incisors. *Upper* and *lower teeth*, exclusive of incisors.

Type. ♀ ad. (in alcohol). Lombok, 2500 ft., June 1896. Collected by A. Everett, Esq. Brit. Mus. no. 97.4.18.4.

2. Rhinolophus megaphyllus Gray. (Plate III. fig. 2 *a*, *b*, *c*.)

Diagnosis. Allied to *Rh. simplex*, but considerably larger. Forearm 46–50 mm.

Details. This is a large continental representative of the *simplex*-type. The evidences of its close connection with the Lombok species are clear enough: the general shape of the facial portion of the skull; the wide interspace between the upper canine and p^1; the presence, individually at least, of an extremely narrow interspace between p^2 and p^4; the distinctly constricted sella; the strong development of the nose-leaves; the large ears. On the other hand, it has in several respects taken its own course of development: the sella is, also proportionately, broader than in *simplex*, the constriction at the middle is more abrupt; the nasal swellings are, also proportionately, considerably broader; the size of the animal is markedly increased: as regards this latter, *Rh. megaphyllus* bears quite the same relation to *Rh. simplex* as *Rh. rouxi* does to *Rh. borneensis*.

*Distribution**. Eastern Australia. Louisiade Archipelago.

Geographical races. There are two apparently well-marked forms of *Rh. megaphyllus*, differing in size and in geographical habitat.

2 *a*. Rhinolophus megaphyllus Gray, typicus.

Rhinolophus megaphyllus J. E. Gray, P. Z. S. 1834, p. 52.

Rhinolophus megaphyllus (partim) Peters, MB. Akad. Berlin, 1871, p. 306 †; Dobson, Cat. Chir. Brit. Mus. (1878) p. 110.

Diagnosis. Larger: forearm 46·5–50 mm.

Sella. In one, out of eleven specimens, the summit of the sella is completely square-cut; in all the others (some of them from the same locality) it is broadly rounded off. Conf. with this *Rh. borneensis*.

Colour. (1) Dark phase (two skins, one adult and one full-grown, but young): Like *Rh. simplex*.

(2) Russet phase (one skin, full-grown individual, but young): Uniform "russet" above and below; base of hairs of upper side "clay."

Measurements. On p. 80.

Distribution. Eastern Australia: Queensland, New South Wales.

Technical name. The type of *Rh. megaphyllus* is in the British Museum.

* The information on the "distribution" of the species and subspecies reviewed in this paper is based *exclusively* on the material examined by myself.

† I am unacquainted with Peters's hypothetical *Rh. keyensis*, based on an example in the Leiden Museum, and characterised as "eine vielleicht nur etwas kleinere Varietät [of *megaphyllus*] oder Art" (*l. s. c.* p. 307). No further information has been published, and nine years later Peters records "*Rh. megaphyllus*" from the Key Islands without any reference to *Rh. keyensis* (Ann. Mus. Civ. Genova, xvi. (1880) p. 32). It is not very likely that the typical *Rh. megaphyllus* should occur in the Key Islands.

2 *b*. Rhinolophus megaphyllus monachus, subsp. n.

Diagnosis. On an average smaller than the typical form: forearm 46 mm.

Details. Sella a trifle broader at base than in the typical form; summit completely square-cut; front face a little more distinctly haired. Length of forearm almost as in the smallest individuals of the typical form, but metacarpals distinctly shorter. Tail also comparatively somewhat shorter. Brain-case decidedly more slender. Tooth-rows somewhat shorter. In colour scarcely different from the dark phase of the typical form.

Measurements. Below.

Type. ♀ ad. (in alcohol). St. Aignan's Island (Misima), Louisiade Archipelago. Collected by Albert S. Meek, Esq. Brit. Mus. no. 98.4.1.1.

Measurements of Rh. simplex *and* megaphyllus.

	Rh. simplex.	*Rh. megaphyllus.*		
	♀ ad. Type.	f. *typica*. 11 specimens, 5 skulls.		*monachus*. ♀ ad. Type.
		Min.	Max.	
	mm.	mm.	mm.	mm.
Ears, length	18	18	19·5	19·8
„ greatest breadth	13·5	13·5	15	15
Nose-leaves, total length	14·5	15	16·2	14·8
„ breadth of horseshoe	8·5	8·8	9·8	8·8
Forearm	44·2	46·5	50	46
3rd metacarpal	31·8	33·8	36	32·7
III.[1]	13	13	14·6	13·2
III.[2]	17·8	17·5	20	17·8
4th metacarpal	32	34·3	36·8	33·5
IV.[1]	9·2	9·8	11·2	9·7
IV.[2]	11	11·5	13·3	10
5th metacarpal	31·8	34·3	36·5	32·7
V.[1]	10	10·4	12·7	10·2
V.[2]	11·2	11·7	14	11·7
Tail	24·5	22·2	26·8	20·5
Lower leg	19·7	18·5	22	19
Foot	8·8	9	10·2	8·7
Skull, total length	18·7	19·9	20·5	19·3
„ mastoid width	9	9·8	9·8	9·5
„ width of brain-case	7·8	8·5	8·6	8
„ zygomatic width	9·4	...	10	9·6
„ supraorbital length	6	6	6·8	5·9
„ width of nasal swellings	5·2	5·8	6	5·7
Mandible, length	12·8	13·3	14	13·2
Upper teeth	7·2	7·7	8·1	7·3
Lower teeth	7·8	8·2	8·7	8

3. Rhinolophus truncatus Peters.

Rhinolophus truncatus Peters, MB. Akad. Berlin, 1871, p. 307.

Rhinolophus megaphyllus (non Gray), var. *a*, Dobson, Cat. Chir. Brit. Mus. (1878) p. 111.

Diagnosis. Allied to *Rh. simplex*. Sella more slightly constricted

at middle. Summit of sella square-cut, or even concave. Base of fur almost blackish. Forearm 44·7–46·8 mm.

Details. In this species the sella* is not of the shape characteristic of *Rh. simplex* and *megaphyllus*. It is narrower, not considerably broader at the base than at the summit, and the constriction at the middle is less distinct. This points decidedly away from *simplex*, and towards *nanus*, *celebensis*, and *borneensis*. The square-cut (or concave) summit of the sella seems to be a rather common feature in those forms of the present section of the group which are inhabitants of small islands (cf. *Rh. megaphyllus monachus*, *Rh. nanus*, *Rh. borneensis spadix*). Lancet long and cuneate. Wing-structure and proportionate length of tail as in *simplex*. Plagiopatagium inserted on tarsus.

Colour (six skins; adult individuals, but teeth quite, or almost, unworn). Very peculiar. General impression: a very dark brown. Details: hairs of upper side "broccoli-brown" at tip; below the tip, for a broad space, almost "clove-brown" (more exactly: an exceedingly dark shade of "hair-brown," very much approaching clove-brown); the extreme base of the hairs, immediately at the skin, again somewhat lighter. Individual hairs of the under side much of the same colour, but the tips more brightly broccoli-brown, giving the under side a somewhat lighter appearance. All the specimens are exactly alike in colour.

Skull. Essential characters as in *Rh. simplex*. Nasal swellings narrow.

Dentition. p_3 is, if anything, a little more reduced than in *simplex*. In two skulls I find it placed in the tooth-row, but slightly towards the external side; in a third, on the one side half external, on the other external; in a fourth, external on both sides, and the interspace between p_2 and p_4 therefore very narrow. p^2 is always in the tooth-row; its cusp rather well developed, though somewhat smaller than in *simplex*. No interspace between p^2 and p^4.

Measurements. On p. 84.

Distribution. Batchian.

Technical name. One of the two typical specimens (in the Berlin Museum) was collected on Batchian by A. R. Wallace and forwarded to Prof. Peters by Tomes. The whole series in the British Museum is from the same island and the same collector, and four of the examples belong to the recently acquired Tomes Collection; they are therefore practically (though not technically) co-types.

Remarks. The dentition of *Rh. truncatus* proves it to be on a slightly higher level than *simplex*; the interspace between the upper canine and p^4 is a little narrower, p^2 a little more reduced. The vacillation in the position of p_3 gives evidence of the same tendency as in *simplex*: towards the more advanced members of the group. In the shape of the nose-leaves it has taken a course pointing towards *borneensis*. In its coloration it seems to stand alone.

* A good series of skins, but no spirit-specimens, are at my disposal. This description is from the *resoftened* nose-leaves of three examples.

4. Rhinolophus nanus, sp. n. (Plate III. fig. 3.)

Rhinolophus megaphyllus (non Gray), var. β (partim), Dobson, Cat. Chir. Brit. Mus. (1878) p. 111 (Goram).

Diagnosis. Essential cranial characters as in *Rh. truncatus*, but brain-case remarkably slender. Sella so slightly constricted as to be practically parallel-margined. Small: forearm 43·3 mm.

Details. This species marks a further step towards the *celebensis-borneensis* type. Externally *Rh. nanus* is exceedingly like these two species, but the skull is of the *simplex* type.

The sella (compared with that of the foregoing three species) is considerably reduced in breadth; its width at the base is but very little greater than at the summit; the constriction at the middle is much reduced (it requires some attention not to be overlooked); and the whole of the sella therefore might very well be called almost parallel-margined; summit completely square-cut (there will probably, in a large series, be some individual variation in this respect). The horseshoe, too, is a little narrower. Lancet almost cuneate, the lateral margins being but very slightly concave. The size of the ears, both length and breadth, is reduced; the tip slightly more attenuated (less blunt than in *Rh. simplex*). In the structure of the wings it stands exactly on the same level as the foregoing species.

Colour (one skin; adult; teeth almost quite unworn).—Fur of the upper side uniform dull "mars-brown"; base of hairs slightly lighter; under side very much of the same colour as the upper side, but with a slight tinge of "drab."

Skull. Postnasal depression and supraorbital crests as in *Rh. simplex*. Nasal swellings very narrow (4·9 mm.). Chief character (compared with the three foregoing species): the very narrow brain-case (7 mm.).

Dentition. p_3 quite external, and cingula of p_2 and p_4 in contact (a sufficiently large series will presumably show some vacillation in the position of p_3). p^2 in the tooth-row; its cusp very small.

Measurements. On p. 84.

Type. Ad. (skin). Goram Island. Collected by Dr. A. R. Wallace. Brit. Mus. no. 61.12.11.10.

Remarks. This species is readily distinguished from *Rh. celebensis* and *Rh. borneensis* by the different shape of the facial portion of the skull.

Dobson regarded the specimen here described, together with two others from N. Celebes (Menado), as a variety ("β") of *Rh. megaphyllus*, characterised chiefly by having "the summit of the vertical process of the sella broadly rounded off, much broader than the base." But, firstly, it should be remembered that a sella, much broader at summit than at base, would be exactly the reverse of what is found in *megaphyllus*; it would even be unique in the whole genus. Secondly, on resoftening the nose-leaves I found the sella, in all the three specimens, quite of the same general shape as in *Rh. borneensis*, *i.e.* practically

parallel-margined. It would evidently have been much more to the point if Dobson had called these Bats *Rh. borneensis*, not *Rh. megaphyllus*. But *Rh. borneensis*, again, was confused with *Rh. minor*, which, however, not only is a distinct species, but belongs to a different group of the genus.

5. Rhinolophus celebensis, sp. n. (Plate III. fig. 4 *a*, *b*.)

Rhinolophus megaphyllus (non Gray), var. *β* (partim), Dobson, Cat. Chir. Brit. Mus. (1878) p. 111 (Menado).

Diagnosis. Supraorbital crests meeting at a point more or less in front of the middle of the orbit. Nasal swellings narrow. Nose-leaves as in *Rh. nanus* and *Rh. borneensis*. Small: forearm 43–44·7 mm.

Details. In the foregoing species (*Rh. simplex*, *megaphyllus*, *truncatus*, *nanus*), all of which are Australian or Austro-Malayan, the supraorbital crests join the sagittal crest at a point more or less *behind* the middle of the orbit. In *Rh. celebensis*, as in all the other species of the present group, which are all Oriental, Palæarctic, or Ethiopian, the supraorbital crests meet at a point more or less *in front* of the middle of the orbit. This makes a comparatively shorter postnasal depression, the supraorbital crests being the lateral borders of this depression. In this point therefore *Rh. celebensis* agrees with the *Western* forms of the group, differing from the Eastern.

The mechanical reason for this modification is evidently the following: a slight increase in the size of the temporal muscle has pushed the sagittal crest more forwards; this involves a shortening of the supraorbital crests; this again a reduction in the length of the postnasal depression.

The nasal swellings are narrow (4·8 mm.), as in the closely related Eastern forms (*nanus*, *truncatus*). In the more Western *Rh. borneensis* they are, at least somewhat, and as a rule considerably, broader. Compare figs. 4 and 5 on Pl. III.

It is worth noticing that the cranial characters of this species are, so to say, "in accordance with" its geographical habitat: Celebes is, geographically, intermediate between the Austro-Malayan and Indo-Malayan subregions, and in its more important cranial characters *Rh. celebensis* points partly westwards (shortening of supraorbital crests), partly eastwards (narrow nasal swellings).

The nose-leaves, ears, wings, and the general size are as in *Rh. nanus* and *Rh. borneensis*.

Colour. (1) Makassar specimen (♀ ad.; in alcohol; unfaded; teeth unworn).—General impression of upper side: brown; the true colour is a deep brown shade of "drab"; base of hairs a little lighter than drab; under side drab with a tinge of "broccoli-brown."

(2) Menado specimens (two skins; ad.; teeth almost unworn).—Above uniform dull "mars-brown," base of hairs but

slightly lighter; colour of the fur of the under side very much as on the upper side.

The Makassar specimen seems to represent the true "dark phase"; the mars-brown tinge of the Menado skins may indicate a tendency towards a "russet phase." Similar differences in colour are very common in this section of the group.

Dentition. As in *Rh. nanus.*

Measurements. Below.

Type. ♀ ad. (in alcohol). Makassar, S. Celebes, November 1895. Collected by A. Everett, Esq. Brit. Mus. no. 97.1.3.19.

Distribution. Celebes: Makassar, Menado.

Measurements of Rh. truncatus, nanus, *and* celebensis.

	Rh. truncatus.		*Rh. nanus.*	*Rh. celebensis.*	
	6 specimens, 4 skulls.		Ad. Type.	3 specimens, 3 skulls.	
	Min. mm.	Max. mm.	mm.	Min. mm.	Max. mm.
Ears, length	...	...	...	16	...
„ greatest breadth	...	...	...	12·5	...
Nose-leaves, total length	...	...	...	12·3	...
„ breadth of horseshoe	...	...	...	8	...
Forearm	44·7	46·8	43·3	43	44·7
3rd metacarpal	31·2	32·3	30	30·5	31·4
III.[1]	13·2	14	11·2	12·2	13
III.[2]	18·2	19·1	...	17·3	17·8
4th metacarpal	32	33·5	31·1	31·3	32
IV.[1]	9·8	10·6	8·8	9	9·7
IV.[2]	11·2	12·5	...	10·8	11
5th metacarpal	31·7	33·2	31·1	31	32·5
V.[1]	10·7	11·7	9	9·5	10
V.[2]	11·8	11·9	9·8	11	...
Tail	23	...	...	20	...
Lower leg	18·8	20	...	17·8	18·3
Foot	...	...	...	8·5	...
Skull, total length	...	...	...	18·1	...
„ mastoid width	9·2	...	...	9	...
„ width of brain-case	...	...	7	8	...
„ zygomatic width	...	...	...	9	...
„ supraorbital length	5·5	5·7	5·8	4·8	4·8
„ width of nasal swellings	5·1	5·1	4·9	4·8	4·8
Mandible, length	12·8	13·1	13	12·2	12·7
Upper teeth	7·1	7·3	7·2	7	7·2
Lower teeth	7·8	7·9	7·8	7·4	7·8

6. Rhinolophus borneensis Peters. (Plate III. fig. 5 *a*, *b*, *c*.)

Diagnosis. Similar to *Rh. celebensis*, but with broader nasal swellings. Small: forearm 41·2–46·3 mm.

Details. Sella so slightly constricted as to be almost parallel-margined from base to summit; in some individuals the constriction is completely obsolete; height of sella about 3 mm.;

width at base, at middle, and at summit: 2, 1·8, and 1·7 mm. Lancet almost cuneate, or the lateral margins but slightly concave, never abruptly narrowed at the middle (as in *Rh. rouxi*); length of lancet about 4·2 mm. Ears and wings quite as in *Rh. celebensis*. Plagiopatagium inserted on tarsus, or as much as 1·5 mm. above the tarsal joint.

Colour. There is an extreme dark phase and an extreme red phase, connected by several intermediate stages.

(1) Dark phase.— ♀, Banguey Isl. (Brit. Mus.); two ♂, Pulo Sarutu (Un. St. Nat. Mus.); all of them *full-grown*, but with *unworn teeth*; distal epiphyses of metacarpals in two of them ossified, in one not completely so; in alcohol, unfaded. General impression of upper side: brown. The true colour is a deep brown shade of "drab"; base of hairs next to "broccoli-brown." Under side between "wood-brown" and "broccoli-brown." The individuals are not precisely, but almost, alike in tinge.

(2) Intermediate stage, nearer to "dark phase."— ♂ ad., ♀ ad., Labuan (B.M.); ♂ ad., N.W. Borneo (B.M.); teeth either *quite unworn*, or *almost unworn*; distal epiphyses of metacarpals ossified; in alcohol, unfaded. Upper side "russet," base of hairs but slightly lighter. Under side "wood-brown."

(3) Intermediate stage, nearer to "red phase."— ♀ ad., Sirhassen (U. N. S. M.); ♂ ad., ♀ ad., Karimata (U. N. S. M.); teeth either *quite unworn*, or very slightly worn; distal epiphyses of metacarpals ossified; in alcohol, unfaded. Much like the foregoing, but also the under side of the body "russet."

(4) Extreme red phase.— ♂ ad., Sirhassen (B.M.); *teeth unworn*; epiphyses ossified; in alcohol, unfaded. Much like the extreme red phase of *Rh. rouxi*: not far from "cadmium orange" above; "orange" beneath.

As proved by the above, these differences in colour are independent of the geographical habitat and of the sex of the individuals, seemingly also of the age. So far as the present material goes, the only "phase" in which a quite young, though full-grown, individual occurs (epiphyses not quite ossified) is the dark phase; but it may be accidental: the individual which represents the extreme red phase is, at all events, only a few months older (teeth unworn).

Skull. As in *Rh. celebensis*, but with broader nasal swellings (5·4 mm., on an average).

Dentition. p_3 almost always completely external, but in one skull (out of eleven) half in row. Cingula of p_2 and p_4 in contact (six), or very slightly separated (four), or distinctly separated (one). p^2 always in the tooth-row; cusp very small. In four individuals there is an extremely narrow interspace between p^2 and p^4 (the former place of p^3).

Distribution. N. Borneo; S. Natunas; Karimata Group.

Technical name. The type of *Rh. borneensis*, in the Berlin Museum, is from Labuan. There are two specimens from the

same island in the British Museum *. As, however, *Rh. borneensis* has for many years been completely confused not only with several more or less closely related species, but also with the widely different *Rh. minor*, the following remarks may not be out of place here :—

The salient point in the original description of *Rh. borneensis*, as given by Prof. Peters (*loc. infra cit.*), is this: "Sattel . . . . an dem vordern obern Ende abgerundet, die hintere, zusammengedrückte Spitze [*i. e.* the posterior connecting process] *kaum höher, abgerundet.*" I have emphasised the last three words, because they clearly prove that *Rh. borneensis* belongs to what here is called the *simplex* group (connecting process low and rounded off), and has nothing to do with *Rh. minor* or its allies (connecting process projecting and pointed). But ten years later (MB. Akad. Berlin, 1871, p. 306), Peters himself believed *Rh. borneensis* to be identical with *Rh. minor*, described by Horsfield so long ago as 1824. The reason was, beyond all doubt, this: to identify Horsfield's Bats without an examination of the types is, in most cases, impossible; and Peters had not seen the type of *Rh. minor* (then in the Indian Museum, London, now in the British Museum), but only the bad figure in the 'Researches in Java'; as, furthermore, the two species in many respects (size, wings, sella, ears, &c.) are, *externally*, puzzling alike, the mistake is easily explained. Thus, according to Peters, there were two small Indo-Malayan *Rhinolophi*: the one, with a low and rounded connecting process, he called *Rh. minor*, Horsf. (synonym: *Rh. borneensis*, Peters); the other, with a projecting and pointed connecting process, he identified with Temminck's *Rh. pusillus*, stated to be from Java. Under these circumstances, a quite reasonable conclusion: we had a name for either "species," and perfectly clear diagnoses.

Dobson, who examined the type of *Rh. minor*, states, quite correctly, that the connecting process is projecting and pointed; when, *nevertheless*, he put *Rh. borneensis* down in the list of "synonyms" to *Rh. minor*, he must have overlooked the most important point in Peters's description of *borneensis*, the shape of the connecting process. Dobson, therefore, called the small Indo-Malayan *Rhinolophus* with *pointed* process *Rh. minor* (synonym: *Rh. borneensis*): thus, the names were the same as employed by Peters, but the diagnosis exactly the reverse; Temminck's *Rh. pusillus* he identified with *Rh. hipposiderus* (sic); and as to the small Indo-Malayan *Rhinolophus* with *rounded* process (the true *borneensis*) he put it down under *Rh. affinis*, Horsf. (!), with which species he also united the very different *Rh. rouxi*, Temm., at the same time keeping a genuine *Rh. rouxi* separate as *Rh. petersi*. This accumulation of errors and wrong identifications

* On one point there is a discrepancy between Peters's description of *Rh. borneensis* and the series before me: according to Peters the length of the forearm is 37 mm.; in the smallest (adult) specimen I have seen, it measures 41·2 mm. I am informed by Prof. Matschie, who kindly re-examined the type for me, that Peters's statement must be a misprint or a slip of the pen; the forearm of the type specimen (a rather young, but apparently full-grown individual) measures 41 mm.

is the true reason of the exceedingly confused state in which this group of Bats has remained, making a safe determination of specimens procured almost impossible.

Geographical races. There seems to be two forms of *Rh. borneensis*, differing, slightly, in the size of the ears, and in geographical habitat.

6 *a*. Rhinolophus borneensis Peters, typicus.

Rhinolophus Borneensis Peters, MB. Akad. Berlin, June 25th, 1861, p. 709.

Rhinolophus minor (partim, nec Horsf.), Peters, MB. Akad. Berlin, 1871, p. 306; Dobson, Cat. Chir. Brit. Mus. (1878) p. 114.

Rhinolophus affinis (partim, nec Horsf.), Dobson. op. cit. (1878) p. 112.

Diagnosis. Ears slightly shorter: 16–17 mm., and narrower: 12·2–12·8 mm. Forearm 41·2–43·7 mm.

Details. In one specimen (from Banguey Isl.) the summit of the sella is completely square-cut; in the others (Labuan, N.W. Borneo) it is broadly rounded off. This is, no doubt, an individual variation, but, it would seem, of more frequent occurrence in individuals inhabiting smaller islands (cf. *Rh. megaphyllus monachus*, *Rh. nanus*, *Rh. truncatus*, *Rh. borneensis spadix*).

Measurements. On p. 88.

Distribution. N.W. Borneo; Labuan; Banguey.

6 *b*. Rhinolophus borneensis spadix Miller.

Rhinolophus affinis rouxi (non Temm.) Thomas, Nov. Zool. i. (1894) p. 656.

Rhinolophus spadix Gerrit S. Miller, Jr., Proc. Wash. Ac. Sci. iii. (March 26th, 1901) p. 136.

Diagnosis. Ears slightly longer: 17–19·5 mm., and broader: 12·5–14·2 mm. Forearm 42·5–46·3 mm.

Details. In one specimen (Sirhassen Isl.) the summit of the sella is completely square-cut; in all the others (one of them from the same island) it is broadly rounded off.

Measurements. On p. 88.

Distribution. S. Natunas (Sirhassen); Karimata Group (Karimata and Pulo Sarutu).

Technical name. The type of "*Rh. spadix*," in the Washington Museum, is from Sirhassen. There is a specimen from the same island in the British Museum. I am indebted to Mr. Miller for the loan of a paratype, also from Sirhassen, and of the series from the Karimata Group, collected by Dr. Abbott.

Remarks. I should not have separated these two forms (if they be so) of *borneensis*, if the latter of them had not, accidentally*, got a name. There is no tangible difference in the skulls, not even

* When describing *Rh. spadix* as a new species, Mr. Miller compared it with *Rh. affinis*. He could not, very well, compare it with *Rh. borneensis*, which was regarded as identical with *Rh. minor*.

(as might perhaps be expected) in the measurements of them. It may well be that the few examples from N.W. Borneo, Labuan, and Banguey (four only) happen to be rather short-eared (and short-armed), and therefore do not show the true limits of individual variation in these respects. I prefer to keep them separate, provisionally at least, to call attention to the *possible* existence of two very slightly differing forms of the species.

7. Rhinolophus virgo, sp. n.

Diagnosis. Similar to *borneensis*, but much smaller. Forearm 37·5–38·8 mm.

Details. This is decidedly the smallest species of the present group. The horseshoe is markedly narrower than in any other form of the *borneensis* type; the sella considerably smaller than in *borneensis*, but of the same shape; the ears much shorter and narrower.

Colour. Probably not far from being the same as in the dark phase of *borneensis* (the two specimens examined are evidently somewhat faded in alcohol).

Measurements of Rh. borneensis *and* virgo.

	Rh. borneensis.				*Rh. virgo.*	
	f. *typica*. 4 specimens, 4 skulls.		*spadix*. 6 specimens, 7 skulls.		2 specimens, 2 skulls.	
	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Ears, length	16	17·1	17·2	19·5	14·7	15·2
„ greatest breadth	12·2	12·8	12·5	14·2	10·7	10·8
Nose-leaves, total length	12·5	13·7	12·7	14·2	10·7	11·2
„ breadth of horseshoe	8	8·3	8	9	7·2	7·2
Forearm	41·2	43·7	42·5	46·3	37·5	38·8
3rd metacarpal	28·7	31·2	28·8	32·7	27·2	28·2
III.[1]	12·1	13·5	11·7	14·2	10·2	10·7
III.[2]	16·2	18·7	16·6	19·9	15·2	15·2
4th metacarpal	29·7	32·2	30·7	34·5	28	28·6
IV.[1]	8·8	9·7	8·2	9·8	7·3	8·2
IV.[2]	10	11·8	9·8	12	9	9
5th metacarpal	29·8	32·2	30·7	33·8	27	28·2
V.[1]	9·5	10·3	9	10·3	8·1	8·8
V.[2]	10·2	11·8	9·8	12·2	8·2	8·3
Tail	18	19·2	18·3	21·5	17·9	20·2
Lower leg	17·8	19·2	17·2	19	14·2	15·2
Foot	8·8	9	8·5	9·1	7·2	8
Skull, total length	...	19·5	18·2	20	16·2	16·9
„ mastoid width	..	9·2	8·8	9·5	8	8·2
„ width of brain-case	...	8	7·8	8·2	7·1	7·7
„ zygomatic width	...	9·8	9	9·9	8·1	8·2
„ supraorbital length	5·1	5·2	5	5·2	4·7	5
„ width of nasal swellings	5·3	5·7	5·2	5·5	4·3	4·3
Mandible, length	12·2	13·1	12·2	13·7	10·8	11·5
Upper teeth	7	7·2	7	7·6	6·1	6·2
Lower teeth	7·5	7·8	7·4	8	6·5	6·8

Skull. As in *borneensis*, but considerably smaller; the nasal swellings are, also proportionately, narrower than in the Bornean species (perhaps as a consequence of the much smaller nose-leaves).

Dentition (two skulls). p_3 half in row (one skull), or external (the other). p_2 and p_4 in the former skull, of course, separated; in the latter almost in contact. p^2 in the tooth-row. Upper canine and p^4 widely separated.

Type. ♀ ad. (in alcohol). S. Camarinas, Luzon, Philippine Islands. Collected by L. M. McCormick, Esq. Un. St. Nat. Mus. no. 101966.

Remarks. This species is readily distinguished from any other form of the *simplex* group by its small size, narrow horseshoe, and short ears. The shape of the connecting process ought to prevent a confusion with the equally small species of the *minor* group, to which it, in other respects, bears a very striking *external* resemblance.

8. Rhinolophus malayanus Bonhote. (Plate III. fig. 6.)

Rhinolophus malayanus Bonhote, Fasc. Malayenses, Zool., i. (Oct. 1903) p. 15.

Diagnosis. Closely allied to *Rh. borneensis*, but median anterior nasal swellings somewhat more differentiated. Small: forearm 41·2–42·8 mm.

Details. Externally this Bat is exceedingly like *Rh. borneensis*, but the shape of the anterior nasal swellings is somewhat different. The colour, too, seems to be *constantly* different.

The sella is, in vertical direction, a trifle shorter, but the difference is scarcely appreciable without actual comparison with *borneensis*. The lateral margins of the sella are, practically, parallel from base to summit; an extremely faint constriction can be traced, at least under a lens; summit of sella rounded. Plagiopatagium inserted on tarsus, or very nearly so.

Colour. (1) Biserat specimens; two ♀ ad.; August and September; teeth slightly worn; in alcohol; unfaded.—Upper side a rather dark brown shade of "drab"; this colour is confined to the tips of the hairs; the much broader base of the hairs so light "ecru-drab" as to approach whitish; under side whitish "ecru-drab," somewhat darker on the sides of the body.

(2) Laos specimen; ad.; teeth slightly worn; skin.—Very much lighter. Upper side bright "cinnamon," base of fur "cream buff"; horseshoe patch * on back dark brown; under side buff.

* A dark-coloured patch on the upper side of the body, horseshoe-shaped, or like a V, the branches starting on each shoulder, convexity (or angle-point) directed backwards. It is curiously characteristic of many species of the families *Rhinolophidæ* and *Phyllostomatidæ*, but often (quite individually) more or less, or even completely, obliterated, especially, of course, when the fur also is dark-coloured. Being, as a rule, more common and more distinct in young or immature individuals, it is, probably, an inheritance from some remote ancestors of the two families. *Rhinolophidæ* and *Phyllostomatidæ* have, probably, had a common origin.

It looks like a dark and a light "phase." The dark phase differs from that of *Rh. borneensis*, chiefly, in having the under side of the body much lighter, in strong contrast to the colour of the upper side, and in having also the base of the hairs of the upper side much lighter. The light phase is, as will be seen from this description, totally different from the "cadmium orange" phase of *borneensis* (and more approaching the light phase of *Rh. affinis himalayanus*).

Skull. Essential characters as in *Rh. borneensis*, but the median anterior nasal swellings somewhat more distinctly marked off from the lateral anterior swellings.

Dentition. p_3 external; p_2 and p_4 almost in contact; p^2 in row, cusp extremely small.

Measurements. On p. 92.

Distribution. Biserat (Jalor, Malay Peninsula). Laos Mts. (Siam).

Technical name. The type is in the British Museum.

Remarks. From the Laos Mountains, Siam, I have seen one dried skin only (Tomes Collection); it looks like a light-coloured phase of *Rh. malayanus*; the nasal swellings of the (fragmentary) skull have the shape characteristic of this species. But fresh material from that region is desirable.

9. Rhinolophus nereis, sp. n. (Plate III. fig. 7 *a*, *b*, *c*.)

"*Rhinolophus rouxii*?" (non Temm.) Gerrit S. Miller, Jr., Proc. Wash. Ac. Sci. ii. (Aug. 20th, 1900) p. 234.

Diagnosis. Allied to *Rh. borneensis*, and of about the same size, but with much larger skull and teeth. Lower leg considerably longer: 21 mm. Tail comparatively very short: 17 mm. Forearm about 45 mm.

Details. In addition to the above:—The second phalanx of the third finger is more than $1\frac{1}{2}$ the length of III.^{1}; this is the first time we have to note a decisive lengthening of III.^{2}; in *Rh. borneensis*, as in all the foregoing species, III.^{2} (always, in this paper, measured without the terminal cartilaginous rod) is invariably less than $1\frac{1}{2}$ the length of III.^{1}; compare with this *Rh. stheno*, *thomasi*, *affinis*, *ferrum-equinum*. IV.^{1} is comparatively shorter than in *Rh. borneensis*, only about $\frac{1}{4}$ the length of the metacarpal of the same finger; compare with this *Rh. stheno*.

Colour. ♀ ad. (type); September; teeth almost quite unworn; first preserved in formalin, now in alcohol; probably unfaded.—"Mars-brown" above; base of hairs "ecru-drab"; of a peculiar yellowish "drab" beneath (? the yellow due to the influence of formalin).

Skull. Of the same general shape as in *Rh. borneensis*, but much larger, with considerably larger teeth, and therefore longer tooth-row; orbital constriction very narrow. The following measurements, in millimetres, will give a more precise idea of the differences (the ciphers in brackets are the measurements of eleven skulls of *Rh. borneensis*):—total length, inion to front

of canine 21·2 [18·2–20]; length of brain-case, inion to anterior point of proencephalon 13·7 [11·3–12·5]; width of brain-case above zygomata 9·5 [7·9–8·2]; zygomatic width 10·8 [9–9·9]; maxillar width, across antero-exterior corners of m^3 8·5 [6·8–7·2]; interorbital constriction 2·2 [2·4–2·8]; palatal bridge, median length 2·6 [1·8–2·3]; maxillar tooth-row 8·7 [7–7·6]; extreme width of m^1 2·2 [1·5–1·9].

Dentition. I have not seen the mandible of this Bat. p^2 in row; cusp almost imperceptible.

*Measurements**. On p. 92.

Type. ♀ ad. (in alcohol). Pulo Siantan, Anambas Group; September, 1899. Collected by Dr. W. L. Abbott. Un. St. Nat. Mus. no. 101714.

Remarks. As already pointed out above, the Bats of the *borneensis* type inhabiting the S. Natuna and Karimata groups, rather *close* to the north-western and western coasts of Borneo, are so extremely like the typical *borneensis* as to be, perhaps, scarcely separable. But *farther westwards*, on the much more *isolated* Anambas Islands, the *borneensis* type has developed into the present, peculiarly modified species. In the lengthening of III.^{3}, the shortening of IV.^{1}, and the shortening of the tail (compared with the tibia), *Rh. nereis* has taken the same course as the still more western *Rh. stheno* (described below). But the shape of its skull sufficiently proves it to be an offshoot, not of that species, but of *Rh. borneensis*. Compare with this the "remarks" under *Rh. stheno*.

10. Rhinolophus sthexo, sp. n. (Plate III. fig. 8, *a*, *b*.)

Diagnosis. Allied to *Rh. borneensis*, but anterior nasal swellings much more projecting. Lower leg long: 19·8–20·8 mm. Tail extremely short: 15·5–17·8 mm. Slightly larger than *borneensis*: forearm 45·2–48 mm.

Details. This is a third modification of the *borneensis* type, in several respects recalling *Rh. nereis*, in others quite peculiar. The shape of the facial portion of the skull is unique within the present group. As in *Rh. nereis*, III.^{2} is lengthened, IV.^{1} shortened; the tail is extremely short. The general size of the animal is slightly increased.

Plagiopatagium inserted 1–3 mm. above the ankle-joint.

Colour. ♂ ad., Penang; teeth unworn; skin.—General impression: reddish brown above; under side much lighter, contrasting with the upper side. "Mars-brown" above; base of hairs light "drab"; under side almost "broccoli-brown."—Three spirit-specimens (Selangor; teeth unworn) apparently agree in colour with the skin.

Skull (three individuals). Owing to the much more projecting anterior nasals wellings, the skull of *Rh. stheno*, in side view, is strikingly different from that of *Rh. borneensis*. This peculiarity

* The tip of the ears and the posterior nose-leaf are damaged; forearms broken.

in its outline is produced, not by a heightening of the anterior swellings, but by a reduction of the posterior pair; these latter, which in all the allied species form a sort of transition between the anterior swellings and the adjacent part of the supra-orbital crests and interorbital constriction, are in *stheno* so much reduced as to leave the anterior swellings more isolated, *i. e.*, more *abruptly* projecting.

Dentition. p_3 external; p_2 and p_4 in contact; p^2 in row, cusp extremely small.

Measurements. Below.

Type. ♂ ad. (in alcohol). Selangor, Malay Peninsula. Presented by H. N. Ridley, Esq. Brit. Mus. no. 98.3.13.1.

Distribution. Selangor; Penang.

Remarks. Rh. stheno differs from *Rh. borneensis* in the series of characters pointed out above. From *Rh. nereis*, in the shape of the facial portion of the skull, the much slenderer brain-case, and the shorter tooth-rows. From *Rh. rouxi*, in the shape of the facial portion of the skull; the much shorter metacarpals (although the forearm is of the same length as in smaller individuals of *rouxi*); the long III.[2] (compared with III.[1]); the short IV.[1]

Measurements of Rhinolophus malayanus, nereis, *and* stheno.

	Rh. malayanus.		*Rh. nereis.*	*Rh. stheno.*	
	3 specimens, 2 skulls.		♀ ad. Type.	4 specimens, 3 skulls.	
	Min. mm.	Max. mm.	mm.	Min. mm.	Max. mm.
Ears, length	16·2	16·8	...	17	17·5
„ greatest breadth	12	12·5	13·7	13	13·2
Nose-leaves, total length	13·2	13·2	...	13·8	14·2
„ breadth of horseshoe	7·8	8	9	8	8·3
Forearm	41·2	42·8	?45	45·2	48
3rd metacarpal	30	31	?33·2	31·5	32·7
III.[1]	11·1	12	13·2	12·6	13
III.[2]	15·3	16·8	21	20·1	21·7
4th metacarpal	30·2	31·5	33·7	33	33·8
IV.[1]	8·8	9·3	8·7	8·2	8·8
IV.[2]	10	10·5	12·8	11	12·5
5th metacarpal	30	31·5	34	33·5	34·2
V.[1]	9·7	9·8	10·8	9	10·4
V.[2]	9·7	10	10·2	10·5	11·5
Tail	19·2	20·5	17	15·5	17·8
Lower leg	16·8	17·8	21	19·8	20·8
Foot	7·8	...	9·3	8·5	9·2
Skull, total length	18·4	...	21·2	19·7	20·2
„ mastoid width	8·8	...	10·2	9·3	10
„ width of brain-case	8	...	9·5	8·5	8·7
„ zygomatic width	9·2	...	10·8	...	10·1
„ supraorbital length	5·1	5·2	5·6	5	5·1
„ width of nasal swellings	5·2	5·6	5·8	...	5·5
Mandible, length	12·1	12·7	...	13·2	...
Upper teeth	6·8	7	8·7	7·4	7·9
Lower teeth	7·3	7·5	...	8·1	8·4

(compared with the fourth metacarpal); the excessively short tail; and the smaller hind foot.

Phylogenetically, *Rh. stheno* is evidently more closely connected with *Rh. nereis* than with any other hitherto known Bat. To call the resemblance between these two species (in III.^{2}, IV.^{1}, the tail) "convergence," would be a phrase only, not an explanation. There can scarcely be any doubt that the type of *Rhinolophus* to which the now existing *Rh. borneensis* belongs, sent off a branch *westwards*; a part of this branch, isolated on the Anambas Islands, developed into *Rh. nereis*; another part, in the Malay Peninsula, into *Rh. stheno* (cf. the diagram on p. 120).

11. Rhinolophus rouxi Temm. (Plate III. fig. 9 *a*, *b*, *c*, *d*.)

Diagnosis. Allied to *Rh. borneensis*, but larger, and with considerably longer metacarpals. Third metacarpal 34–38 mm. Forearm 46–51·5 mm.

Details. This is a large, continental representative of the *borneensis* type, characterised chiefly by the much longer metacarpals and the shape of the lancet. In general size, the continental *Rh. rouxi* bears the same relation to the insular *Rh. borneensis* as the continental *Rh. megaphyllus* does to the insular *Rh. simplex*.

The sella is practically parallel-margined from base to summit; not rarely some faint indication of a constriction at the middle can be traced; summit broadly rounded off. In *simplex* and its closest allies the lancet is long and quite (or almost) cuneate; in *borneensis* there is some tendency towards a slight emargination of the lateral margins of the lancet; this tendency has been carried almost to an extreme in *rouxi*: the lancet is *hastate*, i. e., abruptly narrowed in the middle, the tip well developed and slender (not abnormally shortened, as in *thomasi*); but still, individually (though, as it seems, rather rarely), in *rouxi*, the lancet is less abruptly narrowed, as an atavism towards a passed stage. The ears are as in *borneensis*.

Wing-structure almost on the *simplex-borneensis* stage, *i. e.*, III.^{2} almost always *less* than $1\frac{1}{2}$ the length of III.^{1} The rare individual exception, that III.^{2} is equal to (or a mere trifle more than) $1\frac{1}{2}$ the length of III.^{1}, is of some interest as foreshadowing the next important step to be taken in the series of evolution, viz., from *rouxi* to *affinis*, in which species III.^{2} is *always considerably more* than $1\frac{1}{2}$ the length of III.^{1}

Plagiopatagium inserted on, or 1–4 mm. above, the tarsus, *i. e.*, there is evidently some tendency to draw the insertion of this membrane *away* from the ankle-joint, a little higher up on the tibia; compare with this *Rh. affinis*. The proportionate length of the tail is as in *borneensis*.

Skull. The skull of *Rh. rouxi* is *larger* than that of *borneensis*, but I fail to find any appreciable difference in the shape—a strong evidence of the very close relationship between the two species. The individual variation in the size of the skull, in

rouxi, is rather considerable (as is also the variation in the external dimensions of this Bat); but among 18 skulls of the typical form of *rouxi*, from localities so many and so distant *inter se* as to represent practically the whole area covered by this form, I do not find any so small as the *largest* among 11 skulls of *borneensis* (and *b. spadix*); in so far there is no difficulty in discriminating them. The tooth-rows, too, in *rouxi*, are longer. As to the small S. Chinese race of *rouxi* (described below), the skull has the same length as the *largest* of *borneensis*, but the brain-case is decidedly broader, the zygomatic and maxillar width greater.

Dentition (19 skulls). p_3, most often, quite external (12 skulls); not rarely half in row, or $\frac{3}{4}$ in row (6 skulls); in one *aged* individual (teeth much worn) p_3 is wanting, on both sides of the mandible, and the alveoli have disappeared. Cingula of p_2 and p_4, most often, in contact or separated by a very narrow, sometimes almost hairfine, interspace (13 skulls); in the remaining (6) individuals, distinctly separated, but the width of the interspace is not always quite the same on both sides of the mandible.

The upper canine and p^4 are, with rare exceptions, distinctly separated, p^2 completely in the tooth-row (17 skulls, out of 19), as in all the foregoing species. The size of p^2 and, therefore, the width of the interspace between c and p^4 vary, however, to a certain extent; but in *no* instance is the width of the interspace as broad as (p^2 as well developed as) in *simplex*: this is a thing of the past. As to the remaining two skulls (Ceylon, Nepal), the interspace is very narrow, *p^2 half external*. This is the first time we have to note instances of p^2 not being *completely* in the tooth-row.

As a general conclusion:—(1) In *Rh. rouxi* p_3 has arrived so far on its way towards disappearance as to be, generally, external; but still, not rarely, the individual variation *falls back* to a former stage: p_3 partly in the tooth-row; and in some aged individuals the dentition (p_3 disappeared) *points forwards* to subsequent stages in the series of evolution: *Rh. ferrum-equinum* (p_3 rather often lost) and *Rh. acrotis* (p_3 always lost). (2) As to p^2 in *rouxi*, it is generally in the row, rarely half external; this latter, again, points *forwards* towards subsequent stages: *thomasi*, *ferrum-equinum*, and *acrotis* (p^2 always external, or lost).

Distribution. From S. China through the Himalayas to the Indian Peninsula and Ceylon.

Technical name. As *Rh. rouxi* has for many years been completely confused with *Rh. affinis*, some remarks are necessary to prove that the name *rouxi* belongs to the species here under consideration. The type locality of *Rh. rouxi* is "Calcutta"*; the types (in the Leiden Museum) were collected by the French naturalist, M. Roux. There is in the Tomes Collection (British Museum) a skin also collected by Roux. The essential points

* Temminck, *loc. infra cit.*, p. 30 *c*; Jentink, 'Catalogue systématique des Mammifères,' Mus. d'hist. nat. Pays-Bas, xii. (1888) p. 161 (under *Rh. affinis*).

in the original description as given by Temminck are the following:—

(1) In "taille, forme du corps, des oreilles et des follicules accessoires du nez" very much like Java specimens of *Rh. affinis* Horsf. It may be said so; the difference in the shape of the sella is not easily ascertained in dried skins.

(2) "Des proportions moins grandes," as compared with *affinis*. As measurements Temminck gives:—Of *rouxi*: forearm "1 pouce 10 lignes" (49·5 mm.), expanse of wings "10 pouces." Of *affinis*: forearm "1 pouce 10 lignes," expanse "11 à 12 pouces." 49·5 mm. is one of the commonest measurements of the forearm in the series before me. It looks a little contradictory that Temminck, having stated that *rouxi* is smaller than *affinis* (which is quite correct), gives precisely the same measurement of their forearms, though, at the same time, a considerably larger "expanse" of the latter species. But just that is the salient point. As a matter of fact, the two species *can* have the forearm of exactly the same length (very large *rouxi*, and small *affinis*); but also in that case, *the expanse of* Rh. affinis *is always markedly larger than that of* Rh. rouxi, for the obvious reason that in the former species the second phalanx of the third (longest) finger is always *absolutely* longer than in the latter.

(3) A red, a dark, and an intermediate phase of *rouxi* were known to Temminck. I have the same phases before me. That similar phases occur in *Rh. borneensis* has no bearing on the present technical question; *borneensis* lives far away from "Calcutta." The "phases" of *Rh. affinis* are different.

(4) "Les molaires de la mâchoire supérieure sont en même nombre que dans l'*affinis*, celles de l'inférieure en compte cinq, ou une de moins, par le manque total de la petite dent dont l'*affinis* est pourvu, et qui forme la sixième molaire." Since Temminck emphasises the "manque total" of p_3, I suppose that he has not overlooked this small tooth, but has examined a (probably aged) individual in which it was wanting (*cf.* the specimen mentioned above). The word "sixième" is, of course, a lapsus for "cinquième" (Temminck counted the "molars" from behind forwards).

To sum up:—There can be no doubt that Temminck's *Rh. rouxi* is the Bat here under consideration, being a species (1) bearing much resemblance to *Rh. affinis*; (2) of almost the same size, but with a markedly smaller expanse of wings; (3) with a red, a dark, and an intermediate phase; and (4) inhabiting the Continent of India.

"*Rh. petersi*."—The original description of *Rh. petersi* is meagre and vague; the figures of the head and nose-leaves published four years later are badly drawn; the type specimen (in the Calcutta Museum) has no indication of locality. This may sufficiently account for the fact that no technical name in the genus has been the source of more confusion. I therefore think it of some use to give a brief sketch of its rather complicated history in literature:—

(*a*) As to the identification of "*Rh. petersi*," in the *original*

sense of the term*, there are only two alternatives: it is either *Rh. rouxi* or a species of the *Rh. acuminatus* section. I have not the slightest hesitation in referring the name as a synonym to the former species. As, however, Dobson himself later on applied the name to two Bats of the *acuminatus* section, it will only be necessary to give evidence, from his own description, that he was mistaken. The only important points in the description of "*Rh. petersi*" as given by Dobson in 1872 and 1876, *i. e.* at the time *when he had access to the type specimen*, are the following (the italics are mine)—(1) The nose-leaves are "as in *Rh. acuminatus*, except the upper border of the posterior connecting process, which is *much less acute*." This statement alone would be sufficient. In *acuminatus* the shape of the sella and lancet is very much as in *rouxi*, but the connecting process, both in *acuminatus* and in *all* its allies (*sumatranus*, *calypso*, *audax*), is *projecting* and *pointed*; there is, in this respect, no difference between the species of the *acuminatus* section, and there is also no appreciable individual variation. When, therefore, Dobson in this decisive point (the chief character of the whole group to which *acuminatus* belongs) declares his *Rh. petersi* to be very different from *acuminatus*, it may safely be said that it has nothing to do with that group. Dobson had evidently before him an example of *Rh. rouxi* with a *slightly raised* connecting process ("much less acute" than in *acuminatus*); such individuals are by no means rare; there are several in the British Museum, and the peculiarity is *purely* individual. Dobson found, quite naturally, that this peculiarity recalled that shape of the connecting process which had been described, one year earlier, by Peters in a species called by him *Rh. acuminatus* †, and, consequently, he compared it, in his paper, with this latter species, at the same time emphasising that there was a considerable difference. (2) The figure (side view) in Dobson's 'Monograph,' however bad it is, can scarcely represent the shape of the connecting process in *acuminatus*. Dobson has, no doubt, called the attention of his artist to the connecting process of the specimen to be figured as *Rh. petersi*, and the artist, in due obedience, has made his best to "emphasise" that point: this may account, I think, for the process being somewhat more exaggerated than in ordinary individuals of *rouxi*; but it is still not the process of an *acuminatus*. (3) The measurements of *petersi* are, without any exception, *perfectly* like those of several unquestionable specimens of *rouxi* measured by myself; there is not the slightest indication of a difference. (4) The type of *petersi* is from "India, precise locality unknown." The *acuminatus* section is distributed over Sumatra, Engano, Java, and Lombok. When Dobson wrote his 'Monograph,' there was not, in the Calcutta Museum, any specimen of any species of *Rhinolophus* from those islands; so that, if *Rh. petersi* were a member of the *acuminatus* section, the type, *without locality*, would have been

* Dobson, J. A. S. B. xli. pt. ii. (Dec. 22, 1872) p. 337; id., Monogr. Asiat. Chir. (1876) p. 49, text-figs. *a*, *b*.

† Peters, MB. Akad. Berlin, 1871, p. 308.

the only *Rhinolophus* in the museum from any of those islands. This is, of course, not beyond the limits of possibility; but it is certainly much more likely that *Rh. petersi*, as also the vast majority of the Bats in the Calcutta Museum at Dobson's time, came from some part of the Indian Peninsula or the Himalayas, the habitat of *Rh. rouxi*, and far from the home of *Rh. acuminatus* and its allies.

To describe a new species which subsequently proves to be an old one is no rare occurrence, and, as a rule, it does no very serious harm. But the strong emphasising of a purely individual peculiarity, combined with the circumstance that the type had no "locality," caused in this case a series of confusions: *Rh. petersi* emerged, like a ghost, very unexpectedly at such different places as the Gold Coast, Sumatra, the Himalayas, and S. India. And, curiously enough, the author of the "species" inaugurated the mistakes. When he had returned to London and was working out his 'Catalogue,' Dobson had no longer access to the type of *Rh. petersi*; he had his own short description only, and perhaps some private note. It is quite evident that, in these circumstances and occupied with the study of many other Bats, he lost the precise idea of the type specimen; he only kept in his memory, as its most important character, its "projecting" connecting process. So it came that he referred a specimen labelled "Gold Coast" to *Rh. petersi**; for it is a genuine *acuminatus*, beyond all doubt from Java, and Dobson himself would scarcely have been able to tell why he called it *petersi* instead of *acuminatus*. Two years later, Dobson had for determination a collection of Bats belonging to the Göttingen Museum; among these he again believed he found a *Rh. petersi*†. I have had this example for inspection ‡; it is neither "*Rh. petersi*" nor *Rh. acuminatus*, but *Rh. sumatranus*.

(*b*) In a paper on some Himalayan Bats, Capt. Hutton § records *Rh. petersi* from Masuri. All the Bats mentioned by Hutton were presented to the "Indian Museum," and are now in the British Museum. The two specimens labelled "*Rh. petersi*" are *Rh. monticola*, a species closely allied to *Rh. lepidus* ||.

* Dobson, Cat. Chir. Brit. Mus. (1878) p. 114.

† Dobson, "On some new or rare Species of Chiroptera in the Collection of the Göttingen Museum," P. Z. S. 1880, p. 462.

‡ I am indebted to Geheimrat, Professor Dr. Ehlers, Göttingen, for the loan of this specimen.

§ Hutton, "On the Bats of the North-western Himalayas; with Notes and Corrections in Nomenclature by Prof. W. Peters," P. Z. S. 1872, p. 700.

|| As Hutton's article is one of the very few papers which give information respecting the *habits* of Himalayan Bats, and therefore has been frequently quoted by subsequent writers, I think it advisable to correct the following errors in the identifications of the four species of *Rhinolophus* dealt with in that paper:—"*Rh. affinis*" (p. 696) is *Rh. pearsoni*; "*Rh. rouxi*" (p. 697) is *Rh. affinis*; "*Rh. minor*" (p. 698) is *Rh. rouxi*; and, as pointed out above, "*Rh. petersi*" (p. 700) is *Rh. monticola*. Hutton's Bats were (as also stated in his paper) determined, not by himself, but by Prof. Peters in Berlin. But the mistakes are so strange that they cannot, certainly, be due to Prof. Peters; an extensive confusion of labels must have occurred (I can rather easily, from Peters's point of view, as laid down in his papers, guess the original arrangement of the labels), but the confusion had at all events taken place *before* the specimens were returned to Hutton.

(*c*) In Blanford's 'Fauna of British India' (*loc. infra cit.*) *Rh. petersi* is recorded from Masuri and from Nilghiri. The former statement is borrowed from Hutton's paper. The latter is based on an example collected by W. Davison in Coonoor, Nilghiri*. This specimen is now in the British Museum. It is a *Rh. rouxi*.

In short:—(1) For reasons given above I regard Dobson's *Rh. petersi* (1872 and 1876) as a synonym of *Rh. rouxi*; (2) Dobson's *Rh. petersi* (1878) is *Rh. acuminatus*; (3) Dobson's *Rh. petersi* (1880) is *Rh. sumatranus*; (4) Hutton's *Rh. petersi* is *Rh. monticola*; (5) Blanford's *Rh. petersi* is partly *Rh. monticola* (Masuri), partly *Rh. rouxi* (Nilghiri).

Geographical races. There are, at least, two forms of *Rh. rouxi*, differing in size and geographical habitat.

11 *a*. Rhinolophus rouxi sinicus, subsp. n.

Diagnosis. Skull smaller, tooth-rows shorter. Forearm 46 mm.

Details. The general size is as in the very smallest examples I have seen of the typical form. Skull still a little smaller, with slenderer brain-case and shorter tooth-rows; nasal swellings, in front view, slightly lower. Colour as in the dark phase of Himalayan specimens of the typical form (see below).

Measurements. On p. 100.

Type. ♂ ad. (skin). Chin Tah, Anhwei, Lower Yangtse†. Presented by W. Styan, Esq. Brit. Mus. no. 99.3.1.6.

11 *b*. Rhinolophus rouxi Temm., typicus.

Rhinolophus Rouxii Temminck, Mon. Mamm. ii. 8e monogr. (1835) p. 30 *b*.

Rhinolophus rubidus, *cinerascens*, *rammanika* Kelaart, Prodr. Faunæ Zeylanicæ (1852), pp. 13, 14.

Rhinolophus Rouxii (partim) Peters, MB. Akad. Berlin, 1871, p. 308.

Rhinolophus petersii Dobson, J. A. S. B. xli. pt. ii. (1872) p. 337 (nec Dobson, 1878, 1880); Blanford, Fauna Brit. India, Mamm. pt. ii. (1891) p. 275 (partim).

Rhinolophus minor (non Horsf.) Hutton, P. Z. S. 1872, p. 698.

Rhinolophus affinis (partim, nec Horsf.) Dobson, Cat. Chir. Brit. Mus. (1878) p. 113.

Diagnosis. Skull larger, tooth-rows longer. Forearm 46–51·5 mm.

Colour.—(1) *Specimens from Nepal and Darjeeling.* (*a*) *Dark phase*: one ad.; Nepal; teeth unworn; skin:—Upper side "mars-brown"; horse-shoe patch on back distinguishable, though somewhat obliterated; base of hairs light "drab," almost "ecru-drab"; under side "drab," with a tinge of "russet"; sides of body somewhat darker. With this skin agree in colour another adult specimen from Nepal (teeth somewhat worn; skin) and a ♀ ad. from Darjeeling (in alcohol).

* Blanford, J. A. S. B. lvii. pt. ii. no. 3 (1888) p. 261.

† For the exact position of this locality, see 'Ibis,' 1899, p. 289.

(*b*) *Light phase*: one ad.; Darjeeling; teeth slightly worn; skin:—Above inclining to "clay"; a strongly marked, deep brown horse-shoe patch; base of hairs and fur of under side almost "cream-buff."

(2) *Specimens from Ceylon and S. India.*—(*a*) *Dark phase*: three adult individuals; Ceylon; teeth rather slightly worn; skins:—Upper side a shade of brown, darker and duller than "mars-brown"; horse-shoe patch more or less effaced; base of hairs "drab," with a tinge of "ecru-drab"; under side "wood-brown" or light "drab."—This is Kelaart's *Rh. cinerascens*.

A skin (ad., January, teeth unworn) from Sirzi, Kanara, comes extremely near to the last-mentioned specimen, being only a little darker. A spirit-specimen from Nilghiri seems to be of very much the same colour.

(*b*) *Intermediate stage*: ♂ ad.; January; Sirzi, Kanara; teeth unworn. Upper side between "russet" and "mars-brown"; base of hairs "ecru-drab"; under side almost "clay."—This is Kelaart's *Rh. rammanika*.

(*c*) *Red phase*: one ad.; Ceylon; teeth worn; skin:—Above light "hazel" with a tinge of "orange-rufous"; horse-shoe patch almost obliterated; base of hairs and under side of body light "orange-rufous."—This is Kelaart's *Rh. rubidus*.

A skin (♂ ad., February, teeth unworn) from Jellapur, Kanara, represents the extreme of light colour: upper side next to "tawny-ochraceous"; base of hairs and fur of under side almost "orange-ochraceous."

Conclusions:—The dark phase in specimens from the Himalayas (Nepal, Darjeeling) is of a richer brown, more tinged with russet, than in specimens from Ceylon and S. India (Kanara, Nilghiri). The light phase, in specimens from the Himalayas, seems to be more inclining to "clay"; in specimens from Ceylon and S. India more "hazel" or "tawny-ochraceous." I do not think the series examined affords evidence conclusive enough to justify the separation of a Himalayan "race" and a southern (Ceylonese and S. Indian) "race." In all the other characters (external, cranial, dental; variation in general size) there is no appreciable difference. If they were to be separated subspecifically, the southern form would have to stand as "*Rh. rouxi rubidus* Kelaart," the Himalayan as "*Rh. rouxi typicus*."

Measurements. On p. 100.

Distribution. Himalayas (Darjeeling, Nepal, Masuri). S. India (Nilghiri, Kanara) and Ceylon.

Remarks. Of the two forms here recognised, *Rh. rouxi sinicus* and *Rh. rouxi typicus*, the former, as coming nearest to *Rh. borneensis*, is no doubt the more primitive. The *rouxi*-type, therefore, has spread from an eastern point of the continent westwards, through the Himalayas, down the Indian Peninsula, to Ceylon.

12. Rhinolophus thomasi, sp. n. (Plate III. fig. 10.)

Rhinolophus affinis rouxi? (non Temm.), Thomas, Ann. Mus. Civ. Genova (2) x. (1892) p. 15, pl. xi. fig. 3.

Diagnosis. Allied to *Rh. rouxi*, but p^2 external to the tooth-row. Smaller than *rouxi*, with considerably shorter metacarpals, and the tip of the lancet excessively shortened. Third metacarpal 30·4–31 mm. Forearm 44·8–45·7 mm.

Details. While being similar to *Rh. rouxi* in the shape of the sella and the ears, and the proportionate length of the tail, *Rh. thomasi* differs, externally, from that species in the following particulars :—

The horse-shoe is considerably narrower ; it is even narrower than in the smaller *borneensis* and in the much smaller *malayanus*. The tip of the lancet is exceedingly short, almost rudimentary ; it is the hastate lancet of *rouxi* carried to an extreme.

The general size is smaller, as seen by the measurements of the forearm. But the metacarpals are proportionately *much* shorter, as short as in the much smaller *malayanus*. III.^{2} is comparatively

Measurements of Rhinolophus rouxi *and* thomasi.

	Rh. rouxi.			*Rh. thomasi.*	
	sinicus. ♂ ad. Type.	*typicus.* 30 specimens, 18 skulls.		2 specimens, 1 skull.	
	mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Ears, length	...	16·6	19	16·8	16·8
„ greatest breadth	...	13	15	12	12·2
Nose-leaves, total length	...	13·5	16·2	11·7	11·8
„ breadth of horse-shoe	...	8	9·2	7·2	7·5
Forearm	46	46	51·5	44·8	45·7
3rd metacarpal	34	34	38	30·4	31
III.^{1}	14·6	13·7	15·8	13	13·1
III.^{2}	20·8	18·5	23·5	20·2	20·2
4th metacarpal	34·7	34·5	38·9	31·3	31·9
IV.^{1}	11·2	9·7	12	10	10·2
IV.^{2}	12·3	11·7	14·5	12·2	12·7
5th metacarpal	35·4	35·4	38·9	32·3	32·7
V.^{1}	11·9	10·6	13·2	11	11·2
V.^{2}	11·2	11·2	13·8	9	9·7
Tail	21	21	26·5	19	19
Lower leg	19·8	19	23·5	18	18
Foot	...	9	11·2	8	8·8
Skull, total length	19·8	20·3	23	18·2	...
„ mastoid width	9·5	9·7	10·8	9·2	...
„ width of brain-case	8·7	8·7	9·8	8·7	...
„ zygomatic width	10·3	10·4	11·8	10	...
„ supraorbital length	4·8	4·8	5·8	4·4	...
„ width of nasal swellings	5·8	5·5	5·9	5·3	...
Mandible, length	13·5	13	16·4	12·8	...
Upper teeth	7·7	8·2	9·2	7·1	...
Lower teeth	8·1	8·5	10·3	7·7	...

longer than in *rouxi*, *i. e.* more than $1\frac{1}{2}$ the length of III.[1] (cf. *nereis* and *stheno*). V.[2] is extremely short.

Colour. To judge from specimens preserved in alcohol, probably not far from being the same as in the dark phase of Nepal examples of *Rh. rouxi*.

Skull. The *essential* characters are as in *rouxi*, thus proving *Rh. thomasi* to be an offshoot from that type of Bat, not (as might very well be supposed, in view of the short metacarpals) from *borneensis*. The skull of *Rh. thomasi* agrees with that of *rouxi* in the broad brain-case; it differs from *rouxi* in the much smaller size. Compared with *borneensis*, the skull of *Rh. thomasi* is as small as in the smallest individuals I have seen of *borneensis* (even as small as in *malayanus*), but the brain-case is markedly broader, even broader than in the largest *borneensis*, and the supraorbital length is exceedingly short (*cf.* measurements, p. 100).

Dentition. p_3 external; p_2 and p_4 in contact; p^2 *external. Upper canine and* p^4 *in contact.* Both of the specimens examined are identical in dentition.

Measurements. On p. 100.

Type. ♀ ad. (in alcohol). Karin Hills, Burma, 1888. Collected by Signor Leonardo Fea. Presented by Marquis G. Doria. Brit. Mus. no. 90.4.7.10.

I venture to connect with this fine species the name of Mr. Oldfield Thomas, who already thirteen years ago (*l. s. c.*) pointed out that it could scarcely be identified with any hitherto known form, but refrained from describing it as new, owing to the general confused state of this group of Bats.

13. Rhinolophus affinis Horsf. (Plate III. figs. 11–13.)

Diagnosis. Sella pandurate. p^2 in the tooth-row. Forearm 50–56 mm.

Details. This species marks an important progress in development as compared with *Rh. rouxi*. It is the base of the *ferrum-equinum* section.

The chief modifications are four: in the shape of the sella; in the structure of the wings; in the size of the animal; in the shortening of the palatal bridge.

In the *borneensis-rouxi* type the sella is practically parallel-margined; in *affinis* it is pandurate, *i. e.* the lateral margins concave, as in *ferrum-equinum*, though generally to a slightly less degree. In *simplex* and its closest relations the lancet is almost cuneate; in *borneensis* there is a tendency towards emargination of the lateral margins; in *rouxi* this tendency is carried to an extreme; in *affinis* the lancet falls back to the former stage: it is almost cuneate.

Throughout the whole series of forms reviewed above, with the exception of the somewhat aberrant *Rh. nereis*, *stheno*, and *thomasi*, the wings have remained at the same primitive stage: no lengthening of the second phalanx of the third finger. In *affinis* this phalanx has considerably increased in length, being always more

than, and with very rare exceptions *considerably* more than, 1½ the length of the first phalanx, a peculiarity which is preserved in the subsequent stage of evolution: *ferrum-equinum*. The aberrant species just alluded to, viz. *Rh. nereis*, *stheno*, and *thomasi*, are, from this point of view, of especial interest, as being Bats of the *rouxi* type which already show the wing-structure characteristic of the more highly developed *affinis*.

Rh. affinis is larger than *rouxi*; but small *affinis* have the same length of the forearm as very large *rouxi*. In such cases, *Rh. affinis*, provided the specimens examined are fresh or preserved in spirit, can, of course, easily be discriminated by the shape of the sella and the length of III.^{2}; if preserved as dried skins (in which the shape of the sella is often difficult to recognise), still the latter character remains unchanged.

Colour. The many forms in which this species is differentiated seem to agree, rather closely, in colour:—

(1) Darker individuals: ♂ ad., Darjeeling (*Rh. a. himalayanus*); Oct. 22nd; teeth unworn; skin:—Upper side "mars-brown" with a rather strong hue of "drab"; no horse-shoe patch; base of hairs "ecru-drab"; under side "broccoli-brown."

Still darker is a ♂ ad. from Lombok (*Rh. a. princeps*); teeth somewhat worn; in alcohol; unfaded:—"Prout's brown" above, base of hairs "wood-brown"; under side almost "tawny-olive."

(2) Light-coloured individuals: ♂ ad., Nanking (*Rh. a. himalayanus*); July 5th; teeth somewhat worn; skin:—Extremely light. Above light "clay," almost "ochraceous-buff," hinder back somewhat darker; a rather distinct, "mars-brown" horse-shoe patch; base of hairs "cream-buff"; under side very light, almost "cream-buff."—A spirit specimen (♂ ad.) from the same locality (June 15th) is quite of the same colour.

Skull. The *essential* characters as in *rouxi*, proving that *Rh. affinis* originated from a Bat of that type. The skull is generally larger, and the gap in front between the maxillary bones wider. Chief character: the exceedingly short palatal bridge, as a rule only ¼ the length of the maxillar tooth-row, or *even less*; in *rouxi*, with very rare exceptions, decidedly more than ¼, sometimes almost ⅓. The teeth, too, are slightly larger.

Dentition. p_3 external and extremely small; but, as a rare exception, this premolar may still, in this comparatively highly-developed species, show some tendency towards the tooth-row (one skull, out of 19), or be halfway in row (one). p_2 and p_4 generally quite, or almost, in contact (14 skulls); in the remaining somewhat more distinctly separated. p^2 always in the tooth-row, extremely small, and the interspace between the canine and p^4 rather narrow. In no less than five skulls there is an exceedingly narrow, in most cases almost hair-fine, interspace between p^2 and p^4 (the former place of p^3).

Distribution. From the N.W. Himalayas to S. China; through Indo-China, the Malay Peninsula, and N. Natunas, to Sumatra, Java, and Lombok.

Technical name. The type of *Rh. affinis* is in the British Museum. From the original description it would have been quite impossible to identify the species.

Remarks. Of all the races of *Rh. affinis*, the Himalayan form (*Rh. a. himalayanus*) is the most ordinary-looking: in the horse-shoe, the ears, the nasal swellings, the brain-case. There can hardly be any doubt that *the affinis type originated in the Himalayas*, and from there spread eastwards to S. China, south-eastwards through Indo-China, as far as Lombok.

Geographical races. There are, at least, seven forms of *Rh. affinis*, differing in certain cranial characters, in the size of the ears and horse-shoe, in the length of the tail and tibia, in general size, and in geographical habitat. Some of these forms may be called distinct species by other authors.

13 *a*. Rhinolophus affinis himalayanus, subsp. n. (Plate III. fig. 11 *a*, *b*.)

Rhinolophus affinis (partim) Dobson, Cat. Chir. Brit. Mus. (1878) p. 112.

Diagnosis *. External characters:—Size largest; ears small; horse-shoe narrow; tail short; lower leg short. Cranial: length of skull, width of brain-case, length of tooth-rows, moderate; nasal swellings narrow.

Type. ♀ ad. (in alcohol). Masuri. Collected and presented by Capt. Hutton. Brit. Mus. no. 79.11.21.148.

Distribution. Himalayas (Masuri, Nepal, Darjeeling); S. China (Nanking).

13 *b*. Rhinolophus affinis tener, subsp. n. (Plate III. fig. 12.)

Diagnosis. External characters: Size small; ears small; horse-shoe broader; tail short; lower leg rather long. Cranial: skull short; nasal swellings and brain-case narrow; tooth-rows short.

Type. ♂ ad. (in alcohol). Pegu. Collected and presented by W. Theobald, Esq. Brit. Mus. no. 87.3.4.11.

13 *c*. Rhinolophus affinis macrurus, subsp. n.

Rhinolophus affinis Thomas, Ann. Mus. Civ. Genova (2) x. (1892) p. 922.

Diagnosis. External characters: Size moderate; ears larger; horse-shoe broader; tail long; lower leg longer. Cranial: length of skull, width of brain-case, length of tooth-rows, moderate; width of nasal swellings moderate.

Type. ♂ ad. (in alcohol). Taho, Karennee, Burma; Febr. 1888. Collected by Signor Leonardo Fea. Presented by Marquis G. Doria. Brit. Mus. no. 90.4.4.7.

* As the characters of the different forms of *Rh. affinis* are sufficiently clearly expressed in the table of measurements, p. 105, they will not be reviewed *in detail*, but only rendered in *general terms*, in the "diagnoses" of the subspecies.

13 *d*. Rhinolophus affinis superans, subsp. n.

Rhinolophus affinis (partim) Peters, MB. Akad. Berlin, 1871, p. 306; Dobson, l. s. c.

Diagnosis. External characters: As *macrurus*, but with short tail. Cranial: skull rather long; nasal swellings still broader than in *macrurus*; brain-case broad; tooth-rows rather long.

Type. ♀ ad. (in alcohol). Pahang, Malay Peninsula. Presented by the Selangor Museum. Brit. Mus. no. 0.7.3.2.

Distribution. Lower Siam (Trong); Malay Peninsula (Pahang); Sumatra.

Remarks. A specimen from Sumatra is in every respect, cranial, dental, and external, indistinguishable from those from Pahang and Trong (the latter sent for identification by the United States National Museum).

13 *e*. Rhinolophus affinis nesites, subsp. n.

Rhinolophus affinis Gerrit S. Miller, Jr., Proc. Wash. Ac. Sci. iii. (1901) p. 135.

Diagnosis. External characters: As *superans*, but smaller, and with shorter tibia. Cranial characters unknown.

Type. ♀ ad. (in alcohol). Bunguran Isl., N. Natunas, Aug. 24th, 1900. Collected by Dr. W. L. Abbott. Un. St. Nat. Mus. no. 104753.

Remarks. This is evidently an offshoot of the Malacca form, *Rh. a. superans*, isolated on the outlying N. Natunas, and developed into a well-marked race (or species). It still shows some of the chief characters of *superans*: the large ears, broad horse-shoe, and short tail; but, to judge from the metacarpals (the forearms are broken), it is decidedly smaller, it would seem still a little smaller than *Rh. a. tener*, and the tibia is very short. The skull is so much damaged that I have only been able to examine the teeth and the lower jaw.

13 *f*. Rhinolophus affinis Horsf., typicus.

Rhinolophus affinis Horsf., Zool. Res. Java (1824), pl. [7], figs. A, B.

Rhinolophus affinis (partim) Peters, l. s. c. (1871); Dobson, l. s. c. (1878).

I am unable to give a definite diagnosis of this, the "typical," form of *Rh. affinis*, having seen only one very old skin (the type) and a fragment of the skull, representing the facial portion and the tooth-rows. But these are sufficient to show, first of all, of course, the specific characters (pandurate sella, lengthened III.^{2}, dentition, &c.); secondly, that this form is quite different from any of its next neighbours, on Sumatra and the Malay Peninsula (*superans*), on the N. Natunas (*nesites*), or on Lombok (*princeps*). The horse-shoe seems, allowing for some shrinkage, to be quite as narrow as in *Rh. a. himalayanus*; the nasal swellings, too, are as narrow as in *himalayanus* and *tener*. But, although the

Measurements of Rhinolophus affinis *and subspecies.*

	himalayanus. 6 specimens, 7 skulls.		*tener.* ♀ ad. Type.	*macrurus.* 3 specimens, 3 skulls.		*superans.* 5 specimens, 5 skulls.		*nesites.* ♀ ad. Type.	*typicus.* Ad. Type.	*princeps.* ♂ ad. Type.
	Min.	Max.		Min.	Max.	Min.	Max.			
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Ears, length	17·2	18·5	18·8	20	20·7	20·2	20·5	20·2	...	21·3
„ greatest breadth	13·8	14·5	14·3	15·2	15·8	14·8	15·7	14·2	...	16·9
Nose-leaves, total length	13·9	14	13·8	14·8	16·5	14·8	17	...	...	18·2
„ breadth of horse-shoe	8	8·8	9·5	9	9·8	9·8	10	9·8	?8·1	11·1
Forearm	52	56	50	51	53·8	51·2	53	...	51	52
3rd metacarpal	37·7	40	35·8	37·7	39	36	38·2	35·2	37·5	37·6
III.[1]	15	16	14·3	14·8	16	14·6	15·2	14·3	15·2	15·5
III.[2]	26	30	25	24·8	26·5	23·8	26	24	24·8	24
4th metacarpal	38·8	41·2	37·1	38	40·7	36·8	38·8	36	37·5	39·5
IV.[1]	10·4	11·2	10	10·3	12·2	10	10·9	10·2	10	10·5
IV.[2]	16	18	14·3	14·5	16·5	14	15·3	14·8	13·8	14·9
5th metacarpal	39·2	42·4	38	39·2	41·2	37·7	39·5	36·8	38	39·8
V.[1]	12·3	13·8	11·8	12	13	11·2	11·9	11·5	12	11
V.[2]	12·1	14·1	13·3	13·5	14·8	12·2	13·5	12·2	...	13·1
Tail	21·8	25	23	26	29·3	21·5	25·2	22	...	21
Lower leg	22·8	23·8	24	23·9	25·4	25	25·8	22·8	21	26
Foot	11	12·8	12	11	12	11·1	12	10·2	...	12·4
Skull, total length	22·7	23·9	21·9	22·5	23·2	22·8	23·8	...	...	24·1
„ mastoid width	10·2	10·9	...	10·5	11	10·9	11·2	...	...	11·2
„ width of brain-case	9·2	10	9	9·3	9·8	9·8	10·2	...	...	10·5
„ zygomatic width	11·1	11·8	10·8	11·2	11·6	11·3	12·1	...	...	12·1
„ supraorbital length	5·2	5·5	5·2	5·2	5·9	5·7	6·2	...	5·2	5·9
„ width of nasal swellings	5·6	6	5·7	5·8	6·2	6·2	6·7	...	5·8	6·8
Mandible, length	15·8	16·5	15·5	15·7	16·7	15·8	16·3	15·3	...	17·2
Upper teeth	9	9·4	8·7	8·8	9·2	9	9·7	9	9	9·9
Lower teeth	9·7	10·2	9·2	9·6	9·9	9·7	10·1	9·7	9·7	10·5

specimen is slightly smaller than the smallest example of *himalayanus* I have seen, the tibia is fully as long as (if anything, a trifle longer) than in the very largest of these latter. On the whole, I have but very little doubt that *Rh. a. typicus* will prove to be much more closely related to the Burmese and Himalayan forms than to any of the others. This would be an additional evidence of the *closer* connection between the fauna of Java and that of Indo-China and the Himalayas—closer than between Java and the geographically nearer Sumatra, Malacca, and Borneo.

Distribution. Java.

13 *g.* Rhinolophus affinis princeps, subsp. n. (Plate III. fig. 13.)

Diagnosis. External characters: General size moderate; tail short; but largest in the size of the horse-shoe and ears, and the length of the tibia. Skull, nasal swellings, tooth-rows: the extreme.

Type. ♂ ad. (in alcohol). Lombok, July 1896. Collected by A. Everett, Esq. Brit. Mus. no. 97.4.18.13.

Remarks. Placed side by side with *Rh. a. himalayanus*, this form is strikingly different; the horse-shoe is no less than $\frac{1}{4}$ broader than the *broadest* in *himalayanus*, and the skull is distinguishable at a glance by its excessive width and the very broad nasal swellings. But it must be remembered that *superans* leads, not up to, but decidedly *in the direction* of, *princeps*, and we do not yet know the extreme limits of individual variation, either in *superans* or in *princeps*.

When considering the geographical races * of *Rh. affinis* from a more general point of view—and excluding "*typicus*," owing to the peculiar geological history of Java, as well as *nesites*, owing to its having, probably, been influenced by somewhat exceptional conditions, far away on the small isolated N. Natunas,—the following rule will be observed: the more southern or south-eastern the habitat, the longer the ears, the broader the horse-shoe, the longer the tibia, the larger the skull, the broader the nasal swellings, and the longer the tooth-rows.

14. Rhinolophus ferrum-equinum Schreb. (Plate IV. figs. 14, 15.)

Diagnosis. Sella pandurate. p^2 completely external or wanting. Ears more than 20 mm. Width of horse-shoe less than 10 mm. Forearm 52·8–63 mm.†

Details. The *ferrum-equinum* type originated from a Bat in all

* I am unacquainted with Dobson's *Rh. andamanensis* (J. A. S. B. xli. pt. ii. (1872) p. 337). The only specimen known is in the Calcutta Museum. It seems to be a local representative of the *affinis* type.

† The first and second characters, combined, are sufficient to distinguish *ferrum-equinum* from all Oriental species of this group. The others are added to prevent confusion with those Ethiopian species of the present group which also have the sella pandurate and p^2 external or wanting (*clivosus, darlingi, acrotis*; *augur* and *deckeni*).

essential points similar to *Rh. affinis*. It agrees with the now existing *affinis* in the pandurate sella and the prolongation of III.^{2}. But it is *considerably* higher-developed, chiefly in the following respects: (1) the dentition; (2) the wing-structure; (3) the length of the tail; (4) the beginning, or complete, reduction of the lateral mental grooves; (5) the general size.

The peculiar prolongation of the second phalanx of the third finger, described above under *Rh. affinis*, is preserved in *Rh. ferrum-equinum*: III.^{2} is more than (or, extremely rarely, at least equal to) $1\frac{1}{2}$ the length of III.^{1}. *Also* IV.^{2} *is lengthened, i. e.* more than $1\frac{1}{2}$ of IV.^{1}; it is an interesting fact that, in this particular point, *Rh. ferrum-equinum* (all races) agrees with *Rh. affinis himalayanus*, *but not with any of the other races of affinis*. Besides these two characters, which are simply inherited from an *affinis*-like ancestor, there is an important modification in another part of the wing, to which we have no parallel in any of the foregoing forms*, viz. *a change in the proportionate length of the third, fourth, and fifth metacarpals*, as shown in the subjoined table:—

	Forearm.	3rd meta-carpal.	4th meta-carpal.	5th meta-carpal.
All the foregoing species (94 examples)	1000	715	739	740
Rh. ferrum-equinum (all races; 121 examples)	1000	644	724	743

This table shows:—(1) In all the foregoing 21 forms of this group the fourth metacarpal is but very little longer than the third (24 mm., for a supposed length of forearm of 1000 mm.), and the fifth metacarpal is practically of the same length as the fourth †. (2) In *ferrum-equinum a considerable shortening of the third metacarpal has taken place*; at the same time a much smaller reduction of the fourth metacarpal has occurred, so as to make the fifth metacarpal, slightly but *decidedly*, the longest of all.

The tail is proportionately *longer* than in the foregoing species, being, on an average, in the eastern races of *ferrum-equinum* (*nippon*, *tragatus*, *regulus*) exactly $1\frac{1}{3}$, in the typical form $1\frac{1}{2}$, the length of the lower leg, whereas *proximus*, in this point (as well as geographically), is intermediate between the eastern and western races ‡.

In all the foregoing forms, without exception, there are three

* But there is an exact parallel in an Ethiopian species, of the *affinis* type, viz. *Rh. darlingi* (see the "General Remarks," below, p. 118).

† It would only have made the table more complicated if I had given separate ciphers for all the foregoing species. The only difference (and an exceedingly small one) is that in *simplex*, *megaphyllus*, *truncatus*, *nanus*, *celebensis*, *borneensis*, *virgo*, and *malayanus* the fourth metacarpal is, almost always, a mere trifle *longer* than the fifth; in *nereis*, *stheno*, *rouxi*, *thomasi*, and *affinis* a mere trifle *shorter* than the fifth. However small this difference is, it is evidently the first faint trace of the modification definitely carried out in *ferrum-equinum*: the fourth metacarpal *always* shorter than the fifth.

‡ It is hardly necessary to say that a short tail cannot be a primitive character in the order Chiroptera, taken as a whole. But, for some reason or other, we find in the most primitive species of the genus *Rhinolophus* a very short tail; in the higher forms of the *present* group we see, again, a lengthening of the tail.

vertical grooves on the front of the lower lip. In the eastern races of *ferrum-equinum* (*nippon*, *tragatus*, *regulus*) sometimes exactly the same, but *very often* the lateral grooves are *more or less* reduced; in the western races (*proximus*, *typicus*, *obscurus*) they have, as a rule, almost or quite disappeared *.

As to the general size, the eastern races are, as it seems, always larger than any form of *affinis*; *proximus* and *typicus* at least on an average so; while *obscurus* is nearly of the same size as *affinis himalayanus*.

The remaining external characters need only a brief record :—

The supplementary leaflet is *slightly* more reduced than in *affinis*, and more closely united to the upper lip; this latter it is (more than the reduction) which makes it less distinctly visible. The posterior connecting process is more lengthened in antero-posterior direction, also a little more projecting, but quite rounded off at the summit. But, curiously enough, in one specimen (from Transcaspia) I find the process quite as in *affinis* (in all other specimens from W. Asia it is normal). The lancet has a marked tendency towards assuming a hastate shape, rather than a cuneate, the extreme tip being, generally, long and slender; but sometimes, and both in the eastern and western races (though more often in the former), individuals are found in which the lancet is almost cuneate, as in *affinis*.—These two individual variations are worth noticing, as, both of them, pointing back to *affinis*.

The ears are somewhat modified: more attenuated below the tip, and more pointed.

The plagiopatagium is inserted on the tarsus, on the base of the metatarsus, or about 1 mm. above the ankle-joint. But in one individual (from Cyprus) it is inserted no less than 6 mm. in front of the ankle-joint. It, again, recalls *Rh. affinis*.

Colour. A small series of skins from Tessin, Switzerland, affords some information as to the *difference in colour dependent on the age of the individuals*; all the specimens are of the same sex, from the same locality, and the same month :—

(1) Two full-grown, but *younger* individuals (females, December); distal epiphyses of metacarpals ossified, but teeth unworn; they are probably about six months old :—Upper side

* According to Blanford (J. A. S. B. lvii. pt. ii. no. 3 (1888) p. 263), *Rh. tragatus* Hodgs., regarded by him as a distinct species, and corresponding to what is here called the eastern races of *ferrum-equinum*, has three mental grooves, *ferrum-equinum* one only. If this were so, I should have no objection to separating *Rh. tragatus* specifically from *ferrum-equinum*. But there is, in this as in other respects, a complete intergradation. The details are these :—(1) "*Rh. tragatus*" (10 spirit-specimens): in three individuals (Kashmir, Almora, Darjeeling) the three grooves are perfectly distinct; in three (Masuri, Nepal) the lateral grooves are less distinct than the central one; in two (Nepal) they are so far on the way towards obliteration that it requires close examination to discover them; in the two remaining (Shanghai) they are still more reduced. (2) *Rh. ferrum-equinum* (*s. str.*): rather often traces of the lateral grooves are easily observable; a number of individuals before me, from various places in Europe and W. Asia, have either a slight depression or a short linear groove on either side of the central one; in a specimen from Tübingen (one instance only, among several) they are at least not *more* obliterated than in two "*tragatus*" from Nepal and two "*nippon*" from Shanghai.

greyish "drab," lighter on the head and neck; base of hairs "ecru-drab"; a strongly marked, dark brown horse-shoe patch; under side almost "ecru-drab" on throat and breast, very light "drab" on belly.

(2) One (female, December); teeth almost unworn; must be very nearly of the same age as (1):—Intermediate in colour between (1) and (3), but nearer to (3).

(3) Three *aged* individuals (females, December); teeth worn; two of them are at least $1\frac{1}{2}$ years old, the third (teeth very much worn) still older:—Upper side, a shade of brown which might be described as "mars-brown" with a pronounced tinge of "drab"; base of hairs light "ecru-drab"; scarcely any indication of a horse-shoe patch; under side light "wood-brown" with a tinge of "ecru-drab."

In a series from the Hautes-Pyrénées (January) I find the same differences in colour, but have not been able to verify the comparative age of the individuals by means of the skulls.

Three skins from Minorca (spring) are like the aged Swiss individuals or, if anything, a trifle lighter. The teeth are worn, showing the animals to be, probably, at least about two years old.

Skins of aged individuals from England are indistinguishable from Swiss specimens of a like age. A very young (not full-grown) example from Somerset is quite like the younger (greyish-drab) individuals from Switzerland.

As a general conclusion: young individuals are, broadly speaking, dark grey, old individuals brown; the colour of the young animal is retained, at least in some individuals, till December, beyond the time when the epiphyses of the metacarpals have become ossified. For those who have an opportunity to watch these Bats in the caves during the winter, it would be an object of some interest to ascertain how the colour-change is effected, by a moult or by a recolouring of the hairs.

Skull. The *essential* characters as in *Rh. affinis*, the *general shape* hardly different, but as a rule, of course, the skull is larger. The four anterior swellings are slightly more differentiated; the median ones almost circular in outline, the lateral ones oblong. Chief character: the much longer palatal bridge: very nearly $\frac{1}{3}$ the length of the maxillar tooth-row, a little more or less, but never so short as $\frac{1}{4}$ the tooth-row (as in *affinis*).

Dentition. p_3 external and exceedingly small, or, *very often, lost*, also in younger individuals. p_2 and p_4 in contact. p^2 *completely external*, extremely small, *not rarely lost*, also in younger individuals. Upper canine and p^4 not only in contact, but their *cingula*, as a rule, *considerably overlapping* each other (the cingula of p^4 being external to that of the canine).

Measurements. On p. 115.

Distribution. From S. China and Japan, through the Himalayas, the Mediterranean Subregion (exclusive of Egypt), and Central Europe to S. England.

Geographical races. There are, at least, six forms of *Rh. ferrum-*

equinum, three eastern (*nippon*, *tragatus*, *regulus*), and three western (*proximus*, the typical form, and *obscurus*). They are sufficiently differentiated to need technical names, but in no respect—in the external characters, in the skull, in the dentition—is there a *sharp* "hard-and-fast" line between them:—

In the extreme east (S. China and Japan) we find a Bat (*nippon*) of moderate size and with rather small teeth; the dentition, too, has remained on a rather primitive stage of development; but the horse-shoe and nasal swellings are very broad. Some of these peculiarities, viz. the broad horse-shoe and nasal swellings, are preserved in the Central Himalayan *tragatus*, but the general size of the animal is increased, the skull and teeth very large, the dentition more highly developed. This latter character reaches a climax in the next form, *regulus*, from the N.W. Himalayas, but at the same time the horse-shoe and nasal swellings are markedly narrower; in this respect *regulus* evidently shows tendencies towards the western races, as also might be expected from its habitat.—These three Bats constitute what I call the "eastern" races of *ferrum-equinum*. The geographical line separating them from the western races must be drawn somewhere between Masuri and Gilgit, at the border between the Oriental and Palæarctic Regions. East of that line the individuals are *generally* larger, with broader horse-shoe; the lateral mental grooves *not rarely* fully developed; the tail on an average only $1\frac{1}{3}$ the length of the lower leg.

Passing from Masuri (still *regulus*) to Gilgit, on the extreme north-western, "Palæarctic" side of the Himalayas, we find a form (*proximus*) with small and slender skull, narrower horse-shoe and nasal-swellings; which give it a decidedly "western" aspect, and contrast it with its eastern neighbour, *regulus*; but it has retained the somewhat shorter tail characteristic of the eastern races. The typical form has got rid also of this reminiscence, but, as a matter of fact, also in this race now and then, though rarely, individuals occur which "fall back" to the shorter-tailed eastern stage. The typical form leads to the generally smaller, extreme south-western race (*obscurus*: Spain, Algeria).

A closer study of these races, as compared with the Ethiopian *Rh. augur* and *Rh. deckeni*, will throw some light on the past history of the *ferrum-equinum* type (see the "General Remarks" on the *simplex* group, below, p. 118).

14 *a*. Rhinolophus ferrum-equinum nippon Temm.

Rhinolophus nippon Temminck, Mon. Mamm. ii. 8e monogr. (1835) p. 30 *a*; Temminck & Schlegel, Fauna Japonica (1842), p. 14, pl. iii. figs. 1, 2; Peters, MB. Akad. Berlin, 1871, p. 312.

Rhinolophus ferrum-equinum (partim) Dobson, Cat. Chir. Brit. Mus. (1878) p. 119.

Diagnosis. Size moderate, horse-shoe very broad. Skull small, but with rather broad nasal swellings; tooth-rows very short.

Details.—(1) Compared with *tragatus*: On an average (as a rule also absolutely) markedly smaller: forearm 57·2–59·3 mm. (*tragatus*: 59–63); but the horse-shoe is, nevertheless, of the same excessive breadth: 9–9·5 mm. (*tragatus*: 8·8–9·7). Skull considerably smaller and narrower, but (in conformance with the broad horse-shoe) with rather broad nasal swellings: *comparatively* as broad as in *tragatus*, but, owing to the smaller size of the skull, not absolutely so. Teeth markedly smaller, the tooth-rows shorter.

(2) Compared with *regulus*: Of approximately the same size (or *nippon* rather smaller), but horse-shoe considerably broader: 9–9·5 mm. (*regulus*: 8·2–8·8). Skull generally smaller and narrower, but nasal swellings, nevertheless, quite as broad as in *regulus* (comparatively, therefore, decidedly broader). Tooth-rows markedly shorter.

(3) Compared with the western races: The broad horse-shoe prevents it from being confused with any of the western forms.

Colour. As in adult individuals of *ferrum-equinum* from Europe*. No quite young specimens examined.

Dentition (5 skulls). In two skulls p_3 is present on both sides; in two (teeth unworn) on one side only; in one (teeth very slightly worn) lost, but the alveoli not quite obliterated. p^2 is present in all skulls examined. The cingula of the upper canine and p^4 not only less completely overlap than is generally the case in the other races, but in one skull the two teeth are very slightly, in one *quite distinctly, separated.* This dentition is decidedly more primitive than in the western neighbours of this race, *tragatus* and *regulus.*

Distribution. S. China (Shanghai). Pt. Hamilton. Japan.

Remarks. I find the examples from Shanghai and Pt. Hamilton (S. of Korea) indistinguishable from those from Japan.

14 *b*. Rhinolophus ferrum-equinum tragatus Hodgs. (Plate IV. fig. 14 *a*, *b*, *c*, *d*.)

Rhinolophus tragatus Hodgson, J. A. S. B. iv. no. 48 (Dec. 1835) p. 699; Peters, MB. Akad. Berlin (1871), p. 312.

Rhinolophus ferrum-equinum (partim) Dobson, l. s. c.

Diagnosis. Size largest, horse-shoe very broad. Skull and tooth-rows: the extreme.

Details.—(1) Compared with *nippon*: see this form, *supra.*

(2) Compared with *regulus*: On an average larger, with markedly broader horse-shoe (but no *sharp* line of separation, the maxima

* According to Temminck the fur of *nippon* is "plus long, plus abondamment feutré, plus soyeux et moins lustré" than in *ferrum-equinum* from Europe, and the colours "different également." In the length and abundance of the fur I am unable to find any tangible difference between *nippon*, *tragatus*, and *ferrum-equinum*. As to the colours (two well-preserved skins: Fuji and Nikko), it is quite the same as in darker individuals of *tragatus*, and this again as in fully adult individuals of the typical *ferrum-equinum*; laid side by side these Bats are indistinguishable in colour.

of *regulus* being equal to minima of *tragatus*). Skull generally larger, and with broader nasal swellings.

(3) Compared with the western races: The large size, broad horse-shoe, shorter tail, large skull, broader nasal swellings, and longer tooth-rows prevent it, in most cases, from being confused with any of the western forms.

Dentition. In one only, out of six pairs of mandibles, p_3 is present on both sides; in two (teeth unworn, or very slightly worn) on one side (alveolus disappeared on the other side); in no less than three completely wanting, although the teeth are either quite or almost unworn. A similar high development of the upper teeth (eight skulls): p^2 present in five; completely wanting, and alveoli disappeared, in three (teeth unworn or slightly worn). Cingula of the upper canine and p^4 always overlapping. This is unquestionably a higher stage than in *nippon*.

Distribution. Darjeeling. Nepal.

Technical name. Hodgson's cotypes of *Rh. tragatus* (three examples; Nepal) are in the British Museum.

14*c*. Rhinolophus ferrum-equinum regulus, subsp. n.

Rhinolophus ferrum-equinum Hutton, P. Z. S. 1872, p. 698.

Diagnosis. Size rather large, but width of horse-shoe moderate only. Skull large and broad, with long tooth-rows, but narrow nasal swellings.

Details. Compared with the western races: The large size, combined with the short tail, will, in most cases, make it readily distinguishable. The skull is, almost invariably, larger, the tooth-rows longer.

Dentition (4 skulls). In none of the skulls examined could I find any trace of the lower p_3, although they all have the teeth unworn. In two skulls p^2 is present, in two completely wanting. Cingula of the upper canine and p^4 always overlapping. *This is the highest stage of dentition* in any race of *ferrum-equinum* (in the present group it is surpassed only by *Rh. acrotis*, but this species is an Ethiopian modification not of the *ferrum-equinum* type, but of the *affinis* type).

Type. ♂ ad. (in alcohol). Masuri. Collected and presented by Capt. Hutton. Brit. Mus. no. 79.11.21.153.

Distribution. Almora. Masuri.

14*d*. Rhinolophus ferrum-equinum proximus, subsp. n. (Plate IV. fig. 15.)

Diagnosis. Size moderate, horse-shoe very narrow, tail short, Skull small and slender, with very narrow nasal swellings and short tooth-rows.

Details.—(1) Compared with the typical form: Although being of the same size as the larger and medium-sized individuals of the typical form, *proximus* has a very short tail; in so far, it might, very properly, be characterised as a "typical" *ferrum-equinum*

which has preserved the tail of the eastern races (*cf.* also its geographical habitat); the horse-shoe is remarkably narrow. The skull very small and slender; the nasal swellings narrow.

(2) Compared with *obscurus*: Larger, but *proportionately* with narrower horse-shoe. The skull is even smaller and more slender than in any individual of *obscurus* I have seen.

(3) Compared with the eastern races: The small size, combined with the very small horse-shoe, distinguishes it sufficiently. The skull is smaller and, especially, more slender, the nasal swellings narrower, than in any of the eastern forms.

Dentition (one skull). p_3 and p^2 present. Cingula of the upper canine and p^4 overlapping. This dentition is more in accordance with that of the typical *ferrum-equinum* than that of *regulus*, showing the "western" character of *proximus* (notwithstanding the short tail), a conclusion borne out by the general external aspect of this Bat, and the size of the skull and the tooth-rows.

Type. ♀ ad. (in alcohol). Gilgit. Presented by Dr. J. Scully. Brit. Mus. no. 81.3.1.10.

14 *e*. Rhinolophus ferrum-equinum Schreb., typicus.

Le fer-à-cheval Daubenton, Mém. Acad. Roy. Sci. Belg. 1759, pp. 377, 382, pl. 15. fig. 4.

Vespertilio Ferrum equinum (partim) Schreber, Säugthiere, i. (1775) pp. 174, 188, pl. 62 (the two upper figures).

Vespertilio equinus (partim) P. L. S. Müller, Natursyst., Suppl. (1776) p. 20.

Vespertilio Ungula (partim) Boddaert, Elenchus animalium, i. (1785) p. 71.

Vespertilio Ferrum equinum, *a. major* Gmelin, Linn. Syst. Nat. i. (1788) p. 50.

Vespertilio Hippocrepis (partim) Schrank, Fauna Boica, i. (1798) p. 64.

Rhinolophus uni-hastatus Geoffroy Saint-Hilaire, Descr. de l'Égypte, ii. (1812) p. 132; id., Ann. Mus. d'Hist. Nat. xx. (1813) p. 257, pl. 5.

Rhinolophus ferrum-equinum var. *germanicus* et var. *italicus* Koch, Jahrb. Ver. Naturk. Nassau, 1862–63, pp. 522, 523 *.

Rhinolophus ferrum-equinum (partim) Peters, MB. Akad. Berlin, 1871, p. 310; Dobson, Cat. Chir. Brit. Mus. (1878) p. 119.

Rhinolophus libanoticus, *conchifer*, et *rufescens* "Ehrbg. et Lichtst. Mspt." Peters, loc. cit. (1871) (nomina nuda).

Diagnosis. Size moderate, horse-shoe rather narrow, tail long. Skull rather small and slender, with narrow nasal swellings and short tooth-rows.

* Koch's two "varieties" of *ferrum-equinum* must have been based on too small a material, or there must be some mistake in his statements. That individuals from S. Europe, *i. e.*, Europe S. of the Alps (his "var. *italicus*"), should, generally speaking, be larger than those from Europe N. of the Alps (his "var. *germanicus*"), is at all events not correct. The statement that var. *germanicus* is "über den Rücken mehr braungrau oder aschgrau gefärbt," whereas var. *italicus* "stets in das Röthliche neigt," raises the suspicion whether Koch has not compared immature individuals from Germany with fully adults from Italy.

Details.—(1) Compared with *obscurus*: the subjoined particulars will make the difference evident:—

59 specimens of the typical form have been examined from the following localities:—Transcaspia (1); Euphrates Valley (3); Syria (2); Galilee (2); Cyprus (2); N. Bulgaria (1); Transsylvania (31); Hungary (1); Moravia (2); Dalmatia (2); Turin (1); Genoa (1); Sicily (2); Switzerland (Tessin and Geneva * 7); Tübingen (1).

Forearm, in these specimens, *on an average* 57·5 *mm.* In no less than 44, *i. e.* 75 per cent., the forearm measures 57 *mm. or more* (up to 60·3 mm.); in the remaining (and quite independent of the locality) less than 57 mm. (down to 53·5 mm.).

Of *obscurus* 31 specimens have been examined from:—Troubate, Hautes-Pyrénées (8); Cintra, Portugal (1); Madrid (3); Valencia † (12); Minorca (5); Algeria (2).

Forearm, in these specimens, *on an average* 55·5 *mm.* In no less than 25, *i. e.* 81 per cent., the forearm measures *less than* 57 *mm.* (down to 52·8 mm.); in the remaining between 57 and 58 mm. Although the series is smaller than that of the typical form, the facts here pointed out cannot be due to mere chance; the contrast is too well marked.

As a conclusion: in the typical form the forearm measures generally 57 mm. *or more*; in *obscurus* almost always less than 57 mm.; maximum of *obscurus* is but a trifle larger than the average size of the typical form.

(2) Compared with the eastern races: the proportionately longer tail prevents, in almost all cases, its confusion with any of these races. The skull is rather easily discriminated from that of *tragatus* and *regulus* (*cf.* measurements, p. 115), but I fail to find any point by which to distinguish it from the Japanese *nippon*.

British specimens. 13 specimens have been examined. *Forearm on an average* 55·4 *mm.*, i. e., British specimens of *ferrum-equinum* are on an average of the same size as the extreme south-western (Spanish) race, *Rh. f. obscurus* ‡. Of the 13 specimens, 2 only have the forearm 57 mm. long or more (up to 58 mm., quite as in *obscurus*); all the others between 53·8 and 56·2 mm. These indications require, of course, verification by a much larger series §.

Dentition (11 skulls). In seven skulls p_3 is present on both sides (teeth in very different stages of wear); in one, on one side only (teeth worn); in three (teeth almost unworn, or much worn) completely wanting (no alveoli). p^2 is present in all the skulls examined, two of which are of very aged individuals. Cingula of the upper canine and p^4 generally more or less overlapping, but in two skulls separated by an extremely small interspace. This dentition is almost exactly as in *nippon*.

* For the loan of some Bats from the neighbourhood of Geneva I am indebted to M. Ch. Mottaz.

† A very elaborate table of measurements of fourteen Spanish specimens was kindly sent to me by Prof. A. Cabrera Latorre, Madrid. These are the only examples, dealt with in this paper, not examined by myself.

‡ Compare with this *Rh. hipposiderus minutus*, below, p. 142.

§ To keep the typical form uninfluenced by the smaller British individuals, I exclude these latter from the table of measurements on p. 115.

Measurements of Rhinolophus ferrum-equinum *and subspecies.*

	nippon. 7 specimens, 5 skulls.		*tragatus.* 5 specimens, 8 skulls.		*regulus.* 4 specimens, 4 skulls.		*proximus.* 2 specimens, 1 skull.		*typicus.* 59 specimens, 11 skulls.		*obscurus.* 31 specimens, 4 skulls.	
	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Ears, length	22·4	23·8	21·8	24·5	22	22·8	20·8	21·2	21	23·8	18	22
„ greatest breadth	15·2	17	16·8	18·8	15·2	17·1	15	15·2	15	16·8	13	15
Nose-leaves, total length	15·2	15·8	16·2	17·8	15	15·7	14	14·5	14·5	16·8	13·7	15·5
„ breadth of horse-shoe	9	9·5	8·8	9·7	8·2	8·8	7·7	8	7·8	8·8	7·7	8·5
Forearm	57·2	59·3	59	63	58·7	60	56·8	58	53·5	60·3	52·8	58
3rd metacarpal	37·2	38·8	37·2	40·3	37·3	38·2	36·2	37	34·8	40·2	34	38
III.[1]	19·3	21	20·5	23	19·3	21	19·1	20	18	20·2	15	19
III.[2]	21	32	32	34·5	30·2	32	28·5	29·5	27·2	32·2	27·2	32
4th metacarpal	41·8	44	42	45·1	41·8	43·5	39·8	40·5	38	43·7	37	41·5
IV.[1]	11	12	11·6	13·8	11·2	13·2	10·7	11·7	10·3	12·5	10	11·7
IV.[2]	18·2	19·5	20·2	22	18·7	20·2	18·5	19·5	17·2	20·2	16	20
5th metacarpal	43·1	45·3	43·5	47·3	42·2	44·5	40·8	41	39·4	44·7	38·5	42
V.[1]	13·7	14·5	14	15·8	13·2	14·7	13·1	13·1	12·5	15	12·2	14·5
V.[2]	15·7	17·5	18	19	16·8	17	15·8	17	13·3	17	13·3	17
Tail	31	36·8	34·8	37	31·5	35	31·5	34	34	41	27	37
Lower leg	24·2	26·3	25·6	27·6	23·5	25·8	25·2	25·2	23·8	27·2	23	24·3
Foot	12·7	14·5	13	14·3	12·8	14·2	10·3	11·2	11	13·2	...	...
Skull, total length	22·9	23·7	24·9	25·7	23·7	24·7	22	...	22·7	23·8	22·3	23·2
„ mastoid width	10·2	10·9	11	11·5	10·7	11·2	...	...	10·2	11	10	10·6
„ width of brain-case	9·6	10	10·2	11	9·7	10·5	8·8	...	9·5	9·9	9	9·3
„ zygomatic width	11·7	12·2	12·8	13·3	12·1	13	11·2	...	12·1	12·7	11·3	12·2
„ supraorbital length	5·2	6	5·2	5·7	5·7	6	5·2	...	4·8	6	5	5·5
„ width of nasal swellings	6·3	6·8	6·7	7·2	6·1	6·7	6	...	6·2	6·7	6·2	6·5
Mandible, length	15·8	16·8	17·8	18	16·7	17·2	...	...	15·6	17	15·3	15·9
Upper teeth	8·3	9	9·3	9·9	9·2	9·7	8·8	...	8·5	9	8·5	8·7
Lower teeth	9·3	9·8	10·2	10·7	10·2	10·7	9·3	...	9·2	10	9·2	9·5

Distribution. From Transcaspia and the Euphrates Valley through Southern and Central Europe, exclusive of the Spanish Peninsula.

14*f*. Rhinolophus ferrum-equinum obscurus Cabrera.

Rhinolophus ferrum-equinum obscurus Cabrera Latorre, Mem. Soc. Espaü. Hist. Nat. ii. (1904) p. 257.

Diagnosis. Smaller than the typical form.

Details.—(1) Compared with the typical form: see above, p. 114.

(2) Compared with the Eastern races: the small size, combined with the narrow horse-shoe, make it readily distinguishable. The skull is apparently slightly smaller than in *nippon*.

Dentition (4 skulls). As in the typical form.

Distribution. Spanish Peninsula, with the Balearic Islands. Algeria *.

General Remarks on the Rhinolophus simplex *Group.*

The place of origin.—Of all the existing forms, the Australian *Rh. megaphyllus* is one of the most primitive in dentition. But it is very unlikely that the Australian Continent has been the place of origin of the group. *Rh. megaphyllus* is the only Australian species of the whole *genus*; this might suggest the assumption that it is an immigrant into the country, rather than an ancient inhabitant: secondly, Australia is the extreme eastern border for the group (as well as for the genus), no species being known from the islands to the east of the Continent; it would probably not be so, if Australia had been a centre of dispersal for the group: thirdly, *megaphyllus* has at least two characters which certainly are not primitive—the large nose-leaves, and (probably as a consequence of that) the rather broad nasal swellings: fourthly, *megaphyllus* looks extremely like an enlarged, *continental* representative of the Lombok species, *Rh. simplex* (just as *Rh. rouxi* is the larger, continental representative of *Rh. borneensis*). These arguments seem to support the conjecture that, not the Australian Continent, but the "Indo-Australian Transitional Tract," now broken up into numerous larger and smaller islands, and still inhabited by such very primitive forms as *simplex*, *truncatus*, *nanus*, *celebensis*, and *borneensis*, has been the centre from which the group spread eastwards and westwards.

Differentiation †.—The ancestral species seems to have divided into two branches, an eastern and a western. In the eastern, more primitive branch the sagittal crest does not reach quite so far forwards as a point corresponding to the middle of the orbit; in the western the temporal fossa is comparatively a little wider, and the sagittal crest produced forwards more or less beyond that

* The type of *Rh. f. obscurus*, in the Madrid Museum, is from Valencia, Spain. As will be seen, I take the name in a wider sense. Valencia specimens were separated by Prof. Cabrera, as a distinct subspecies, mainly on account of a difference in the ratio between the length and breadth of the horse-shoe. In a large series of *ferrum-equinum* from Europe and W. Asia there is, however, no small, and quite ndividual, variation in this respect.

† Compare the diagram on p. 120.

point. The geographical line separating the two branches coincides with the line separating the "Austro-Malayan" from the "Indo-Malayan" subregion (Celebes being a part of the latter). The eastern branch is, as yet, represented by four known species *Rh. simplex*, *megaphyllus*, *truncatus*, and *nanus*. The western by all the others.

The further evolution, from *borneensis* to *ferrum-equinum*, has been discussed above, and is summed up, in the briefest possible form, in the subjoined diagram (p. 120). But the sketch of this group would be deprived of some of its most instructive features if the Ethiopian species were left quite out of consideration. They belong to three closely related types:—

(1) *Ethiopian species of the* borneensis-stheno-rouxi *type.*—Far south in Africa, in Bechuanaland and Mashonaland, we find two small species, *Rh. denti* and *simulator*, described quite recently*. *They are the Ethiopian representatives of the* borneensis *type*: the same general shape of the skull; essentially the same dentition; the same parallel-margined sella, with a faint or almost imperceptible constriction at the middle; the same style of connecting process; the same proportionate length of the fourth and fifth metacarpals; even the same length of the tail, &c. But there are, in these species, three characters of especial interest, because they enable us to determine still more precisely their phylogenetic place: the nasal swellings (side view) are more projecting than in *borneensis*, but less than in *stheno*; III.^{2} is lengthened, and IV.^{1} somewhat shortened, as in this species,—proving that *they have originated from a Bat which had already traversed a part of the distance separating* borneensis *and* stheno. The dentition is on a slightly higher level than in *borneensis* and *stheno*, the only difference being that p^2, although still in the tooth-row (as in the Oriental species), shows a distinct tendency *towards* the external side.

In the extreme south of Africa (Cape Colony) we find a species, *Rh. capensis*, which, quite superficially, looks like an enlarged *Rh. simulator*. *It is an African representative of Rh. rouxi*: the skull is to such a degree that of *rouxi* that it would be hard to find any tangible difference, even the measurements being practically the same (on an average smaller than in *rouxi*); the nose-leaves (sella, process, lancet) are the same; proportionate length of fourth and fifth metacarpals, of tail and tibia, the same. But the dentition is somewhat more advanced: p^2 is generally external, but still, very often, a quite distinct interspace between the canine and p^1 indicates its former place; III.^{2} is somewhat lengthened. In short: *Rh. capensis* is a "*Rh. rouxi*" which in the wing-structure has taken a course *towards*, in the dentition very slightly *beyond*, the *affinis*-stage.

(2) *Ethiopian species of the* affinis-*type.*—On the coasts of the Red Sea we find a species, *Rh. clivosus*, first made known by Cretzschmar from Mohila in Arabia; I have seen examples from

* Thomas, Ann. & Mag. Nat. Hist. (7) xiii. (1904) p. 386; Andersen, *op. cit.* (7) xiv. (1904) p. 384.

the African coast of the Gulf of Aden. *It is the closest existing relative of the Himalayan Rh. affinis*: the same shape of the skull; the same shape of the sella, of the connecting process, of the ears; the same structure of the wings (also the same lengthening of III.^{2}); the same proportionate length of the tail. But it is more advanced in dentition: p_3 is not only external (as in *affinis*), but very often lost; p^2, which in *affinis* is still in the tooth-row, is in *clivosus* external and very small. In short: *Rh. clivosus* is a "*Rh. affinis*" with *ferrum-equinum* dentition.

The *clivosus* type has found its way very far into the Ethiopian Region. *Rh. darlingi* *, from Mazoe to Angola, is a modification of this type (as proved by the skull), differing from *clivosus* in the more pronouncedly pandurate sella, the much broader horse-shoe, the much smaller ears, and, by far the most interesting, *in the shortening of the third metacarpal.* This last peculiarity is the same as that pointed out above, under *Rh. ferrum-equinum*: in the wing-structure *Rh. darlingi* differs from *Rh. clivosus* quite in the same way as *Rh. ferrum-equinum* from *Rh. affinis.* It is a suggestive fact to find this peculiarity so exactly copied by the South-African species.

Rh. acrotis †, from Egypt and Erythrea, is, externally, very similar to *Rh. clivosus*; also the wing-structure is the same. But the tendency, in *clivosus*, towards an obliteration of p_3 and p^2 has been further developed by *acrotis*: it has completely lost both of these teeth, thus being, in this particular respect, the highest member of the whole group. *Rh. acrotis* is a "*Rh. affinis*" with a dentition still more advanced than in *ferrum-equinum regulus.*

(3) *Ethiopian species of the* ferrum-equinum *type.—Rh. augur* ‡ is widely distributed, in several geographical races, over the southern part of the Ethiopian Region: the Orange River tract, Natal, the Lower Zambesi. *It is the closest existing relative of Rh. ferrum-equinum*; the skull, the nose-leaves, the wing-structure are the same; but the dentition is a trifle less advanced, and the ears are smaller.

We find the *ferrum-equinum* type also further northwards in Tropical Africa (Mombasa): *Rh. deckeni*; the skull and dentition, and all external characters of any importance, are as in *augur*; but the horse-shoe is broader.

The area occupied by these two Ethiopian representatives of the *ferrum-equinum* type extends, broadly speaking, from the Orange River to Mombasa. It is completely cut off from any other region inhabited by that type of Bat; it forms a large enclave bordered to the north and west by vast tracts where no representative of *ferrum-equinum* occurs; we must go so far away from South and Equatorial Africa as the Euphrates Valley, Syria, and Algeria before meeting with the closest relatives of those Ethiopian species. Thus the question suggests itself, by which way the *ferrum-equinum* type reached Tropical Africa, and why its range there is now so peculiarly insulate. When

* Andersen, Ann. & Mag. Nat. Hist. (7) xv. (1905) p. 70.
† Andersen, *op. cit.* (7) xiv. (1904) p. 454; (7) xv. (1905) p. 73.
‡ Andersen, *op. cit.* (7) xiv. (1904) p. 380.

trying to answer this question, the following facts must be borne in mind:—Firstly, that all palæontological evidence is wanting, which detracts from what we know about the affinities and distribution of the now existing representatives of these Bats. Secondly, that the *ferrum-equinum* type is unknown in Egypt, as well as in the whole region of the continent north of British East Africa, and that we have no reason, of any kind, to believe that it ever existed there. Thirdly, that we have to account not only for the distribution of *Rh. augur* and *deckeni* as compared with the other members of the same section of the genus, but also for the presence in Tropical Africa of representatives of the *borneensis* and *rouxi* types, and, be it noticed, representatives which, without exception, are *more highly differentiated* than their Oriental allies. These facts, so far as they go, seem to allow of no other satisfactory explanation than this: the immigration of these Bats, as of so many other Oriental types in the Ethiopian fauna, has taken place by way of the broad tract of land which, as commonly supposed, in a geologically late period connected Southern Asia with the African continent. In the case of the *ferrum-equinum* type this explanation would make it evident, why it, though vastly distributed in South and Equatorial Africa, is absent from the whole north of the continent with the exception of the extreme north-western (Mediterranean) coast-region, which it, no doubt, has reached from South-western Europe, since the Algerian race is subspecifically indistinguishable from the Spanish form (*Rh. f. obscurus*). In the case of the *borneensis* and *rouxi* types it would account for the fact that they are common to the Oriental and Ethiopian Regions, but absent from the whole of the Palæarctic Region. And it would also account for the presence of the genus *Rhinolophus* in the Ethiopian Region, for, as I shall have to show later on in this paper, all the Ethiopian representatives of the genus are undoubtedly of Oriental origin.

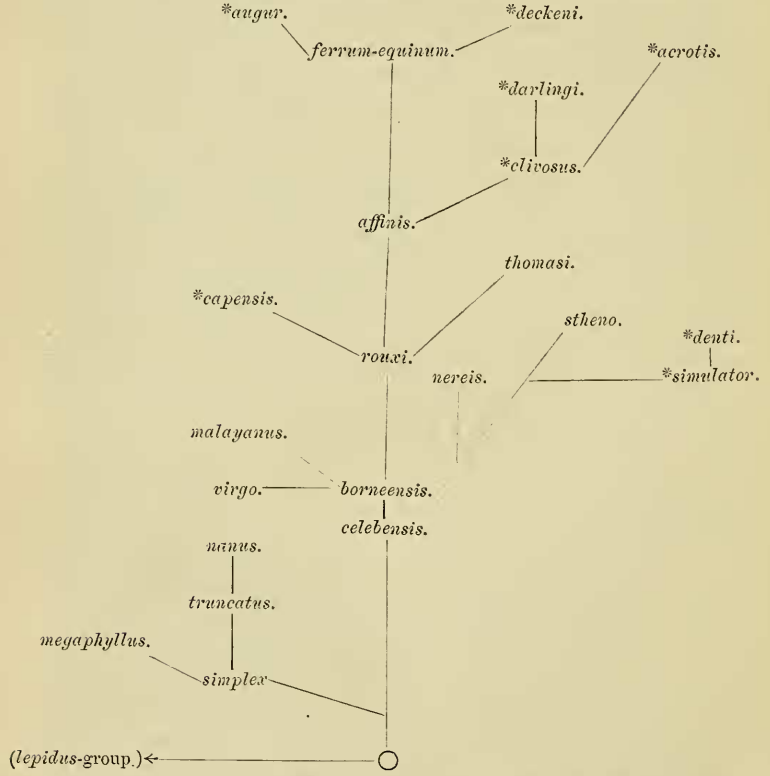
Such being the case, I am able to draw up the following rough sketch of the history of *Rh. augur*, *deckeni*, and their Oriental and Palæarctic relatives:—

The *ferrum-equinum* type has originated somewhere in South Asia; we find there the long series of more primitive forms which lead up to that type, whereas in the whole of the Ethiopian Region there is not any species with which it can be brought in genetic connection. The ancestral "*ferrum-equinum*" broke up into three branches: a south-western, a western, and an eastern. The south-western branch, which had spread directly from South Asia into the Ethiopian Region, was cut off from the main stem by the submergence of the connecting tract of land, and is now differentiated into two species—the southern *Rh. augur* and the northern *Rh. deckeni*. Both of them have retained at least two "ancient" characters: a slightly more primitive dentition (the upper canine and p^4 often more or less separated; p^2 sometimes half in row*) and a short tail. To the external difference

* 35 skulls of *Rh. augur* (all races) have been examined:—In 17 the upper canine and p^4 are more or less separated, in 7 in contact, in 11 more or less overlapping

between these two Ethiopian species, viz. a broad horse-shoe in *deckeni* and a narrow one in *augur*, we have a parallel in *ferrum-equinum*: a broad horse-shoe in *nippon* and *tragatus*, a narrow one in the other races. The western branch spread over South and Central Europe: the dentition slightly more advanced, the tail lengthened. The third branch is now represented by what I have called the Eastern races of *ferrum-equinum*; all of them have retained the short tail; *nippon* (which, so far as the dentition is concerned, has remained on a relatively less advanced stage) leads through *tragatus* to *regulus*, in which the dentition has reached the highest stage of development found in any race of *ferrum-equinum*.

According to this the mutual affinities of the species of the *simplex* group might be expressed as follows† (the Ethiopian species are marked with an asterisk):—



each other at base; *in 4 p^2 is half in row.* To this latter I find no parallel in any specimen of *ferrum-equinum* (all races) I have seen, and in 4 skulls only, out of 33, there is a more or less distinct remnant of the interspace between the canine and p^4. Of *Rh. deckeni* I have seen one skull only; the dentition is as in many specimens of *Rh. augur*: c and p^4 separated, p^2 external.

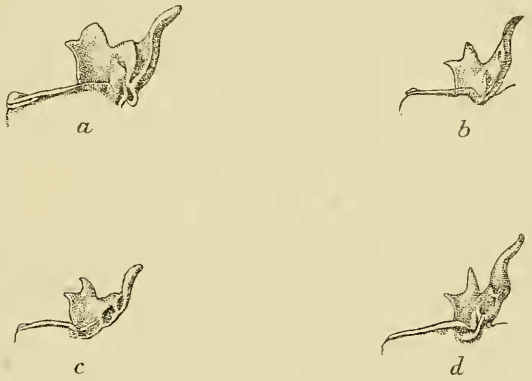
† I give the diagram the form of a genealogical tree, only because it is convenient to

II. The *Rhinolophus lepidus* Group.

Diagnosis. Basioccipital, between cochleæ, not unusually narrowed. Posterior connecting process projecting and pointed.

I include in this group:—(1) All the forms with projecting connecting process comprised by Dobson under the technical name "*Rh. minor*"; their close relationship is unquestionable; their differences will be pointed out below; (2) *Rh. acuminatus* and its allies, which are scarcely more than giant forms of the *lepidus*-type; (3) the *Rh. blasii* and (4) *Rh. euryale* sections, peculiarly modified Ethiopian and W. Palæarctic representatives of the *subbadius*-type. The two former sections only will be reviewed below; the two latter will be briefly mentioned in the "General Remarks" on the group (p. 135).

Text-fig. 22.



Side views of nose-leaves, showing the principal forms of the connecting process in the *Rh. simplex* group (*a*) and the *Rh. lepidus* group (*b*, *c*, *d*).

a. Rh. borneensis typicus; *b. Rh. cornutus pumilus*; *c. Rh. monoceros*; *d. Rh. empusa.*

As this is a first attempt to disentangle the many different forms hitherto confounded with Horsfield's *Rh. minor*, the following preliminary remarks are necessary, as a general guidance:—

The first of the above-named sections (the "*lepidus*-section"), viz., all the *small* Oriental and E. Palæarctic *Rhinolophi* which have the connecting process projecting and pointed, fall into three

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show, at a glance, the probable interrelations of the species. As sufficiently emphasised in the foregoing pages, I am far from being of opinion that *ferrum-equinum* is derived from the *now-existing affinis* (or *capensis* from *rouxi*, or *stheno* from *borneensis*, &c.). But *ferrum-equinum* has originated from a Bat which had the more *essential* characters of *affinis* (besides several others, unknown to us). The technical names in the diagram are, in other words, to be taken, not in their strict specific sense, but as names of the *sections* ("types," "branches") of which the species, as we now see them, are the surviving representatives.

natural groups (sub-sections): the *lepidus*-type, the *minor*-type, and the *subbadius*-type.

I propose to characterise these types at once. It will enable me to confine the diagnoses of the various species to the points in which they differ from the subjoined general characteristic.

(1) The *lepidus*-type.—Chief characters: skull larger, width of brain-case about 7·7–7·8 mm.; connecting process (in side view) projecting as a small, erect triangle (not curved forwards as a sharply pointed "horn").

Description, based on *Rh. lepidus* (Wynaad, Mysore, Indian Peninsula).—Supplementary leaflet as in *simplex* and its allies. Horse-shoe not completely covering the upper lip; a small tooth-like projection on either side of the median notch; front border sometimes, not always, slightly crenulate (individual variation). Sella decidedly broader at base than at summit, slightly, but quite distinctly, constricted at middle, narrow at summit: there is a tendency towards producing an almost subacute summit to the sella (compare with this the *borneensis*-type: sella broadly rounded off, or even truncated, at summit); height of sella 3·2 mm.; width at base, at constriction, and at summit: 2, 1·8, and 1·2 mm. Connecting process projecting as an acute, sometimes only subacute, triangle beyond the summit of the sella. Lancet strongly hastate, about 3 mm. long. Three mental grooves.

Ears much as in the *celebensis-borneensis* type, but somewhat more blunt-tipped.

Wing-structure quite primitive, *i. e.* no lengthening of III.^{2}, this phalanx being always less, and very often much less, than $1\frac{1}{2}$ the length of III.^{1}; no shortening of the third metacarpal; fourth metacarpal slightly the longest (individually it may fall short of the fifth by a fraction of a millimetre). This wing-structure is perfectly like that of *Rh. simplex* and its allies.

Tail slightly longer than (individually equal to, or a trifle shorter than) the lower leg. Plagiopatagium inserted on the ankle, slightly above or below.

Skull. General shape: the *simplex-borneensis* type, but *considerably smaller, with smaller teeth, and shorter tooth-rows.* The orbital cavities (the confluent orbital and temporal fossæ) are shorter and narrower than in *borneensis*, the zygomatic arches, therefore, less projecting laterally, making the zygomatic width of the skull, as a rule, only equal to, or even a trifle smaller than, the mastoid width. These peculiarities combined make, as a rule, the skulls of the species of the *lepidus*-type rather easily distinguishable from those of the *borneensis*-type.—Arrangement of the nasal swellings, essentially, as in *borneensis*. Palatal bridge, on an average, somewhat less than $\frac{1}{3}$, but more than $\frac{1}{4}$ the length of the maxillar tooth-row.

Dentition. Position of p_3 (in, or external to, the tooth-row) "vacillating." p^2 invariably in the tooth-row. This dentition is precisely as in *simplex-borneensis*.

Species. Rh. lepidus, monticola, refulgens.

(2) The *minor*-type.—Chief characters: skull, also proportionately, very small; width of brain-case about 6·8–7·2 mm.; connecting process of the *lepidus*-type (text-fig. 22, *b*, p. 121).

Description, based on *Rh. cornutus pumilus* (Loo-choo Islands).—Nose-leaves as in the *lepidus*-type, but: sella narrower; height about 2·8 mm.; width at base, at constriction, and at summit: 1·7, 1·5, and 1·1 mm. Connecting process slightly higher, slightly more acute, but of the same general shape.

The other external characters as in the *lepidus*-type.

Skull. Considerably smaller; nasal swellings narrower. Teeth smaller.

Dentition. As in *lepidus*.

Species. Rh. minor, *cornutus*, "*minutus*" (Miller, nec Montagu), *gracilis*.

(3) The *subbadius*-type.—Chief character: connecting process long, slender, very sharply pointed, curved forwards, projecting like a small, curved "horn" (text-fig. 22, *c*, p. 121).

Nose-leaves, and other external characters, much as in *minor*, but connecting process as described above; lancet more or less approaching the shape of an equilateral triangle; length of sella about 2·4 mm.; width at base, at constriction, and at summit: 1·7, 1·3, and 0·9 mm.

Skull. To judge from fragments, and the skull of a quite young individual, much of the *minor*-type.

Dentition. As in *lepidus* and *minor*.

Species. Rh. subbadius, *monoceros*.

15. Rhinolophus lepidus Blyth.

Rhinolophus lepidus Blyth, J. A. S. B. xiii. pt. i. (June 1844) p. 486.

Rhinolophus minor (partim, nec Horsf.) Dobson, Cat. Chir. Brit. Mus. (1878) p. 114.

Diagnosis. Skull and external characters: *lepidus*-type. Larger: forearm 41·8–42 mm.

Details. This species differs from *Rh. monticola* in its broader nasal swellings, larger size, and considerably longer metacarpals.

Colour. Ad., skin: Ganges Valley; teeth almost unworn; two ♂ ad., in alcohol: Wynaad; teeth unworn. General colour above between "wood-brown" and "cinnamon," lighter on the anterior part of the back; base of hairs very light "ecru-drab"; under side "wood-brown" or tending to "ecru-drab."

Dentition (three skulls). p_3 external. p_2 and p_4 separated, or almost or quite in contact. p^2 in the tooth-row, with a well-developed cusp, pointing inwards.

Measurements. On p. 125.

Distribution. Indian Peninsula: Wynaad (Mysore); Ganges Valley.

Technical name. I identify this Bat with Blyth's *Rh. lepidus* (to which I find no reference in Dobson's 'Catalogue'), for the following reasons:—(1) *lepidus* belongs to this group of the genus,

as proved by Blyth's description of the connecting process, "still more developed [than in his *Rh. subbadius*] and obtusely angulated behind"; the words "still more developed" mean, evidently, "bigger," not extremely slender as in *subbadius*. (2) The types were "probably obtained in the vicinity of Calcutta"; one of the specimens in the British Museum is from the Ganges Valley, therefore in all probability from the very same locality as the types. (3) The colour, as described by Blyth, agrees very well with that of the specimens before me. (4) The forearm was stated to be "$1\frac{5}{8}$ inches" (41·5 mm.); the longest finger "$2\frac{1}{4}$ inches" (57·2 mm.); the tibia "above $\frac{5}{8}$ inch" (above 16 mm.); all these measurements are as in the British Museum examples: forearm 41·8–42 mm.; third finger 58·3–59·1 mm.; lower leg 16–17 mm. These facts leave no room for doubt as to the identification of *Rh. lepidus*.

16. Rhinolophus monticola, sp. n.

Rhinolophus petersi (errore*) Hutton, P. Z. S. 1872, p. 700.
Rhinolophus minor (partim, nec Horsf.) Dobson, *ut supra*.
Rhinolophus subbadius (non Hodgs., nec Blyth) Scully, J. A. S. B. lvi. pt. ii. (1887) p. 244.

Diagnosis. Skull and external characters: *lepidus*-type. Smaller: forearm about 37·5 mm.

Details. This species differs from *Rh. lepidus* in its narrower nasal swellings, somewhat smaller size, and considerably shorter metacarpals. The horse-shoe seems to be narrower.

Colour. Unknown (faded in alcohol).

Skull. As in *Rh. lepidus*, but somewhat smaller, and with narrower nasal swellings.

Dentition (two skulls, one belonging to a quite young individual). p_3 in row (skull of an adult), or external (young). p_2 and p_4 well separated, or almost in contact. p^2 in row; a distinct cusp, pointing inwards.

Measurements. On p. 125.

Type. ♂ ad. (in alcohol). Masuri. Collected and presented by Capt. Hutton. Brit. Mus. no. 79.11.21.151.

17. Rhinolophus refulgens, sp. n. (Plate IV. fig. 16 *a*, *b*, *c*.)

Diagnosis. Skull and external characters, essentially of the *lepidus*-type. But brain-case somewhat higher in front, making the anterior slope of the sagittal crest, towards the postnasal depression, somewhat more abrupt. Forearm 40·6–41·5 mm.

Details. Very nearly of the same size as *Rh. lepidus*, but metacarpals, also proportionately, somewhat shorter; tibia shorter. The horse-shoe is, if anything, slightly broader.

* There is no doubt that this is an accidental error. Prof. Peters (who determined Hutton's Bats) cannot, possibly, have identified the specimen here under consideration (forearm 37·5 mm.) with "*Rh. petersi*" (forearm of type 51 mm.). As already pointed out above (p. 97, footnote), the labels must have been confused; the name "*Rh. petersi*" was, probably, intended for Hutton's examples of *Rh. rouxi*.

Colour. ♀ ad., skin; Perak; March; teeth almost unworn. Very different from *Rh. lepidus*. General effect of the colour of the upper side: a dark shade of "Prout's brown" with a tinge of "hair-brown." On closer examination the fur of the upper side proves to be composed of two kinds of hair: longer, thinner, straight hairs, quite black; and somewhat shorter, crinkled hairs of a "hair-brown" colour; the mixture of the colours of these two kinds of hair produces the general effect. *Base of hairs of upper side not lighter coloured.* The fur of the upper side has a silvery reflection (iridescence). Under side between "broccoli-brown" and "hair-brown." A spirit-specimen from Selangor (♂ ad., apparently the same age) is of the same colour.

Skull. In addition to the characteristic in the diagnosis: the "maxillar width," across the antero-external corner of m^3 (a character subject to exceedingly small individual variation in the species of the *lepidus*-section) is somewhat larger, giving this part of the skull a somewhat broader aspect: 6·5–6·7 mm.; in *lepidus* 6·2 mm. Gap in front between the maxillary bones somewhat larger.

Dentition (two skulls). p_3 external. p_2 and p_4 almost or quite

Measurements of Rh. lepidus, monticola, *and* refulgens.

	Rh. lepidus.		*Rh. monticola.*	*Rh. refulgens.*	
	3 specimens, 3 skulls.		♂ ad. Type.	2 specimens, 2 skulls.	
	Min. mm.	Max. mm.	mm.	Min. mm.	Max. mm.
Ears, length	15·2	15·6	...	15·7	...
„ greatest breadth	11·5	12·2	...	12	...
Nose-leaves, total length	11·5	12	...	12·1	...
„ breadth of horse-shoe	7	7·2	? 6·2	7·5	...
Forearm	41·8	42	37·5	40·6	41·5
3rd metacarpal	30·8	31·2	28·7	28·3	29·2
III.^{1}	10·8	11·8	10·9	10·8	11·5
III.^{2}	15·8	16·1	14·2	14·2	15·3
4th metacarpal	31	31·2	28·8	29·2	30·2
IV.^{1}	9	9·2	8·3	8·5	8·5
IV.^{2}	10	10·2	9·8	9·5	10
5th metacarpal	30·7	31·6	28	28·8	29·7
V.^{1}	9·8	10	9·2	9	9
V.^{2}	9·8	9·8	9·8	10	10·2
Tail	17	18·3	...	16·7	19
Lower leg	16·6	17	15·3	15·9	16
Foot	8·3	8·7	7·7	8·3	...
Skull, total length	17·7	...	16·8	17·2	17·2
„ mastoid width	...	...	8·1	...	8·4
„ width of brain-case	7·7	...	7·7	...	7·8
„ zygomatic width	8·7	...	8·2	8·3	...
„ supraorbital length	4·5	5	4·4	4·8	5
„ width of nasal swellings	5	5	4·5	4·8	4·8
Mandible	11·1	11·5	11	11·4	11·8
Upper teeth	6·6	6·7	6·3	6·3	6·8
Lower teeth	7	7	6·8	6·9	7·1

in contact. p^2 in row; a small cusp, pointing inwards. In one specimen there is an extremely narrow space between p^2 and p^4 (the former place of p^3).

Measurements. On p. 125.

Type. ♀ ad. (skin). Gunong Igar, Perak, 2000 ft.; March 1898. Presented by A. L. Butler, Esq. Brit. Mus. no. 98.11.29.2.

Distribution. Malay Peninsula: Perak; Selangor.

18. Rhinolophus minor Horsf.

Rhinolophus minor Horsfield, Zool. Res. Java (1824), pl. [7], figs. C, D.

Rhinolophus pusillus Temminck, Mon. Mamm. ii. 8e monogr. (1835) p. 36, pl. 29. fig. 8, pl. 32. figs. 22, 23; Peters, MB. Akad. Berlin, 1871, p. 309.

Rhinolophus brevitarsus Blyth, Cat. Mamm. Mus. Asiat. Soc. (1863) p. 24 (nomen nudum) ("vicinity of Darjeeling").

Rhinolophus minor (partim) Dobson, *ut supra.*

Diagnosis. Skull and external characters: *minor*-type. Ears, tail, and tibia shorter. Forearm 37–38 mm.

Details. This species differs from *Rh. cornutus* by the shorter ears, tail, and tibia (*cf.* measurements). The forearm is, at least on an average, shorter.

Colour. ♂ ad., skin; Darjeeling; November; teeth unworn. General effect of the colour of the upper side very much as in *Rh. refulgens*, though perhaps not quite as dark; *base of hairs light*, "ecru-drab"; under side "ecru-drab," darker on the hinder belly and flanks.

Dentition (three skulls). p_3 in row, almost in row, or external. p_2 and p_4 well separated, or almost in contact. p^2 in row; a small cusp, pointing inwards.

Measurements. On p. 128.

Distribution. Darjeeling. Siam. Java (*cf.* remarks below).

Technical name. Horsfield's type of *Rh. minor* is in the British Museum.

*Rh. pusillus**.—The figure of the head of *Rh. pusillus*, as given by Temminck, proves that he had before him one of the small species of what is here called the *lepidus* group (shape of connecting process, of sella, &c.). The only question is, therefore, to *which* species the name *pusillus* belongs. It would seem to be settled, beyond doubt, by Temminck's statement that the types were brought from Java. But Dobson, who examined these types in the Leiden Museum, gave the rather astounding information that they are "undoubtedly specimens of *Rh. hipposiderus*"! † There is only one answer: if so, an interchange of labels has

* Temminck, ut supra; Dobson, Cat. Chr. Brit. Mus. (1878) p. 117; id. Rep. Brit. Assoc. 1880, p. 175; Peters, MB. Akad. Berlin, 1880, p. 23.

† This is the source of the statement that *Rh. hipposiderus* should occur in Java; there is no other foundation. The range of *Rh. hipposiderus* has its extreme eastern limit in Gilgit (N.W. Himalayas); there is not a single reliable record of that Bat from the whole of the Oriental Region; and the species therefore cannot possibly turn up again in Java.

taken place in that Museum; for the Bat figured and described by Temminck as *pusillus* was certainly no *hipposiderus*; among all the small *Rhinolophi* existing it would be difficult to find a stronger *contrast* to *Rh. pusillus*, in the shape of the connecting process, than *Rh. hipposiderus*.

Remarks. From Java I have seen one old skin only (the type) and a fragment of the skull, representing the nasal swellings and the teeth. It is, of course, not sufficient to prove that the Java Bat is in all particulars identical with that from Darjeeling; but the nasal swellings, the teeth, the connecting process, the horse-shoe, as well as the measurements of the wings and tibia, are the same. If not identical, they are, at all events, extremely closely related.

19. Rhinolophus cornutus Temm.

Diagnosis. Skull and external characters essentially as in *Rh. minor*. Ears, tail, and tibia longer. Forearm 38·8–41 mm.

Details. Cf. *Rh. minor*.

Distribution. Loo-choo Islands, and Japan proper.

Geographical races. There are two races of *Rh. cornutus*, slightly differing in the general size, in the length of the tail and tibia, and in geographical habitat.

19 *a*. Rhinolophus cornutus pumilus, subsp. n. (Plate IV. fig. 17 *a*, *b*, *c*.)

Rhinolophus minor (non Horsf.) Bonhote, Nov. Zool. ix. (1902) p. 626.

Diagnosis. On an average smaller: forearm 38·3–39·7 mm.

Details. See table of measurements, p. 128.

Colour. ♂ ad., ♀ ad., skins; March; teeth unworn. Fur strongly bicoloured, *i. e.* base of hairs strongly contrasting with the tip. *General effect* very much as in the adult *Rh. hipposiderus*. Upper side, anteriorly almost "broccoli-brown," posteriorly next to "Prout's brown"; base of hairs extremely light, almost white with a tinge of "ecru-drab." Under side "ecru-drab," darker on the flanks.

Skull. Quite of the *minor*-type. The teeth seem to be a mere trifle smaller.

Dentition (three individuals). p_3 external; p_2 and p_4 completely in contact. p^2 in row, but the space between the upper canine and p^4 narrower than in the *lepidus*-type and *Rh. minor*; cusp of p^2 so extremely minute as to be scarcely observable (teeth unworn), and the tooth itself a little reduced in size.

Type. ♀ ad. (in alcohol). Okinawa, Loo-choo Islands, March 16th, 1902. Presented by the Hon. N. C. Rothschild. Brit. Mus. no. 2.10.7.18.

Distribution. A skin (skull very incomplete) from Foo-chow (Swinhoe leg.; Tomes Collection) seems to be referable to this form.

19 *b*. Rhinolophus cornutus Temm., typicus.

Rhinolophus cornutus Temminck, Monogr. Mamm. ii. 8e monogr. (1835) p. 37; Temminck & Schlegel, Fauna Japonica, p. 14 (1842) pl. 3. figs. 3, 4; Peters, MB. Akad. Berlin, 1871, p. 309.

Rhinolophus minor (partim, nec Horsf.) Dobson, *ut supra*.

Diagnosis. On an average larger: forearm 39·2–41 mm.

Details. See table of measurements, below. To judge from three spirit-specimens, the plagiopatagium is inserted a little higher up on the tibia (1–3 mm. above the ankle) than in the foregoing forms of this group.

Colour. (1) Tsu-sima: ♂ ad., in alcohol, unfaded; September; teeth unworn. As *Rh. c. pumilus*. A young individual, from Tsu-sima, is still considerably darker.

(2) Japan proper: one skin, three spirit-specimens; teeth unworn. Very different; extremely like *Rh. lepidus*, if anything still a trifle lighter.

Skull. Quite of the *minor* type; measurements slightly larger.

Dentition (five skulls). p_3 almost in row (two), or external (three). p_2 and p_4 well separated (two), or almost in contact

Measurements of Rh. minor *and* cornutus.

	Rh. minor.		*Rh. cornutus.*			
	3 specimens, 3 skulls.		*pumilus*. 3 specimens, 2 skulls.		f. *typica*. 6 specimens, 5 skulls.	
	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Ears, length	15	...	16	...	16	17·5
„ greatest breadth	...	...	12·3	...	12	13
Nose-leaves, total length	...	...	11	...	11·2	12·5
„ breadth of horse-shoe	? 7	...	6·2	...	6·4	6·7
Forearm	37	38	38·8	39·7	39·2	41
3rd metacarpal	26·8	27·5	27·7	28·7	28·2	29·8
III.1	10	10·8	10·7	11·4	11·1	11·6
III.2	13	14·5	12·7	13·2	14	14·8
4th metacarpal	28·1	29	27·7	29·5	28·8	30·7
IV.1	7·8	8·5	8	8·7	8·5	9
IV.2	9	9·8	8·7	9·2	9·9	10·3
5th metacarpal	26·8	28	27·7	29·5	29	30·9
V.1	8·8	9	9	9·5	9·1	9·7
V.2	8·8	9·8	8·5	9·2	10·2	11·3
Tail	15·5	...	18	...	21	22
Lower leg	15·2	15·5	16·2	17·2	17·8	18·4
Foot	...	...	8	...	8·3	9
Skull, total length	15·7	...	...	16	16	17
„ mastoid width	7·8	...	...	7·8	8	8·2
„ width of brain-case	7	...	...	7·2	7	7·2
„ zygomatic width	8	...	...	7·9	7·8	8
„ supraorbital length	4	4·1	3·8	4	4·5	4·7
„ width of nasal swellings	4	4·2	...	4·1	4	4·2
Mandible	10·4	10·4	10·2	10·4	10·5	11·2
Upper teeth	5·9	6	5·7	5·7	6	6·3
Lower teeth	6·2	6·3	6	6·1	6·2	6·8

(three); in none, completely in contact. p^2 in row; a well-developed cusp, pointing inwards. Upper canine and p^4 widely separated; in one skull there is a small interspace between p^2 and p^4 (the former place of p^3).

Distribution. Japan proper.

Remarks. In general size, as well as in the skull and dentition, the Tsu-sima Bat agrees with the typical form; but the colour is that of *Rh. c. pumilus* *.

20. Rhinolophus gracilis, sp. n. (Plate IV. fig. 18 *a*, *b*, *c*.)

Rhinolophus minor (partim, nec Horsf.) Dobson, *ut supra*.

Diagnosis. Skull: the *minor*-type. Sella parallel-margined; tail extremely short. Very small: forearm 36·2 mm.

Details. This is an aberrant species of the *minor*-type. The connecting process is quite of the same shape as in the foregoing species (very different from that of *subbadius*). But the sella is parallel-margined, as broad at the summit as at the base; by means of a lens (probably not without) an exceedingly faint trace of a constriction can be observed; the summit of the sella is broadly rounded off, as in *borneensis*, not with a tendency towards a subacute shape, as in the foregoing forms of this group; length of sella 2·8 mm.; width at base 1·8 mm., at summit 1·7 mm. The lancet is, considering the small size of the Bat, remarkably long (4 mm.), with the lateral margins almost straightly converging towards the tip; it recalls the lancet of *Rh. midas* and *hipposiderus* (with which species *Rh. gracilis* has no very close affinity).

The tail is extremely short (13·5 mm.), shorter than the lower leg. Plagiopatagium inserted a trifle above the ankle.

The colour (a little faded in alcohol) has probably been rather like that of *Rh. lepidus*.

Skull. Quite of the *minor*-type.

Dentition (one skull). p_3 external. p_2 and p_4 distinctly separated. p^2 in row; cusp extremely minute (unworn).

Measurements. On p. 132.

Type. ♀ ad. (in alcohol). Malabar Coast. Purchased. Brit. Mus. no. 73.4.16.2.

21. Rhinolophus subbadius Blyth.

Rhinolophus subbadius Blyth, J. A. S. B. xiii. pt. i. no. 150 (June 1844) p. 486.

Rhinolophus garoënsis Dobson, J. A. S. B. xli. pt. ii. no. 4 (Dec. 22, 1872) p. 337; id., Mon. Asiat. Chir. (1876) p. 48, text-figs. *a*–*c*; id., Cat. Chir. Brit. Mus. (1878) p. 115.

* I have examined a paratype of Gerrit S. Miller's *Rh. minutus* (Proc. Wash. Acad. Sci. 1900, p. 235), the type of which is from the Anambas Islands. It is an offshoot of the *minor*-type, but undoubtedly a distinct species, differing from *Rh. minor* (from Darjeeling) in having the brain-case decidedly higher in front, giving the skull, in side view, a very characteristic outline. The name "*minutus*" is, however, preoccupied by Montagu's "*Vespertilio minutus*," which is the British form of *Rh. hipposiderus*. Mr. Miller will rename the Anambas species.

Diagnosis. *Subbadius*-type (cf. p. 123). The smallest species in the genus: forearm 34·2 mm.

Details. The very characteristic shape of the connecting process, formed as a long, sharply pointed, slightly curved "horn," prevents the confusion of this (and the next-following) species with any of the foregoing forms. Also the shape of the lancet is peculiar: short, broad, almost as an equilateral triangle; but I doubt that this character, in a large series, will prove to be quite as safe a guide for the discrimination of the species as the shape of the connecting process; there is, in all species of *Rhinolophus*, a little more individual variation in the lancet than in other parts of the nose-leaves. The sella is, essentially, of the *minor*-type (not as in *gracilis*), much broader at base than at summit; below the constriction the margins are almost parallel, above the constriction slightly converging; *the summit somewhat more subacute* * than in any of the foregoing species; tip of sella bent forwards.

Plagiopatagium inserted a trifle above the ankle.

The colour (a little faded) is probably not very different from that of *Rh. lepidus*.

Skull. Unknown. I have seen a small fragment only; it seems to be of the *minor*-type.

Dentition (one example). p_3 external. p_2 and p_4 in contact. p^2 in row; cusp small, but distinct.

Measurements. On p. 132.

Distribution. Nepal (type locality). Garo Hills †. (The only example of this species in the British Museum is without exact indication of locality.)

Technical name. Hodgson's "*Vespertilio subbadia*" (J. A. S. B. x. pt. ii. (Nov. 1841) p. 908), from the "Central Region of the Himalayas," is a nomen nudum (no word of description). The head of this Bat is figured in his unpublished drawings (pl. 8. fig. 3); it is not a *Rhinolophus*, but a *Hipposiderus*, probably *H. bicolor* or an allied form.

* I emphasise this peculiarity (and, on the whole, enter into a detailed description of the sella), because it is this "pattern" of sella which has been carried to an extreme in some of the Ethiopian and W. Palæarctic representatives of the *subbadius*-type (*Rh. empusa* and *blasii*; cf. the "General Remarks," pp. 136–37).

† In Dobson's 'Monograph' and 'Catalogue' (l. s. c.) *Rh. garoënsis* (= *subbadius*) is recorded from Masuri. The species is very likely to occur there, only it must be said that till now there is no proof. Its alleged occurrence in Masuri can be traced back to two examples in the British Museum (Capt. Hutton) identified by Dobson with *Rh. garoënsis*. They are, however, *Rh. monticola*, differing in all important points (process, lancet, size) from his own original description of *garoënsis*. Quite as in the case of *Rh. petersi*: as Dobson had no longer access to the type, he lost the precise idea of it. Still later (Rep. Brit. Assoc. 1880, pp. 175–76) he gave up the separation of *Rh. garoënsis* as a distinct species, and then we arrive at the stage when all small Indian and E. Palæarctic *Rhinolophi* with a projecting process were called *Rh. minor*, irrespective of differences in the skull, the process, the sella, lancet, general size, and geographical habitat. What led Dobson to this conclusion was the fact that the position of the lower p_3 varies in individuals from the same locality (which, however, also is the case in all the more primitive species of the *simplex* group, as high up in the series as *Rh. affinis*), and he was quite right in arguing that, from an exclusively *taxonomic* point of view, this character had no value; but he overlooked the other and more important characters by which the members of his composite species differ from each other.

Blyth's *Rh. subbadius* (1844) from Nepal, erroneously believed by himself to be the same as Hodgson's *V. subbadia*, is a genuine *Rhinolophus*. The following analysis of the original description will make it evident that it is the species here under consideration: (1) The connecting process is stated to be "conspicuously developed, and pointed"; one of the chief characters of *subbadius*. (2) The lancet is but "slightly emarginated towards the point"; also one of its principal characters; for the salient point in the sentence is the word "slightly," as proved by a comparison with the immediately subsequent description of *lepidus*, in which the lancet is called "considerably emarginated towards the tip." (3) Forearm "$1\frac{3}{8}$ inches" (34·8 mm.); third finger "$1\frac{7}{8}$ inches" (47·6 mm.); these measurements, as being smaller than in any other species, and like those of the individual before me (forearm 34·2, third finger 46·4 mm.), settle the identification beyond all doubt.

Rh. garoënsis.—Dobson's *Rh. garoënsis* (1872) is evidently the same species as Blyth's *Rh. subbadius** (to which there is no reference in Dobson's 'Monograph' or 'Catalogue'). The two authors emphasise the same points:—(1) The connecting process is described by Dobson as "forming an acutely pointed elevation." (2) The lancet is a "broad, triangular, pointed process," or, as he says in his 'Monograph,' "almost an equilateral triangle"; both of these features are the same as already pointed out by Blyth. (3) The Bat is said to be "probably the smallest known species of the genus," the forearm measuring only 1·3 in. (33 mm.). (4) Width of horse-shoe 0·2 in. (5·1 mm.); a very narrow horse-shoe is also characteristic of the species (5·5 mm., as measured by myself). In the type of *garoënsis* p_3 is, according to Dobson, in the tooth-row; this is of no importance for the identification; the position of this tooth is "vacillating" in the whole *lepidus* section.

22. Rhinolophus monoceros, sp. n.

Diagnosis. *Subbadius*-type. Larger: forearm, in a *not full-grown* example, 38·2 mm.

Details. Connecting process (text-fig. 22 *c*, on p. 121) and lancet as in *subbadius*. Horse-shoe markedly broader. General size considerably larger. Tail proportionately longer.

The type, and only specimen known to me, is not full-grown (supraorbital crests still separated posteriorly; no saggital crest; metacarpals far from having acquired their full length). In the table p. 132 I give only those measurements which may be of some use for comparison with *Rh. subbadius*.

Dentition. p_3 external. p_2 and p_4 in contact. p^2 in row; cusp very minute.

Type. ♀ juv. (in alcohol). Baksa, Formosa; June 5th, 1893. Collected by Mr. P. A. Holst. Presented by Henry Seebohm, Esq. Brit. Mus. no. 94.2.4.1.

* This view was held by the late Dr. Blanford, who, however, put the names down as synonyms of *Rh. minor* (J. A. S. B. lvii. pt. ii. no. 3 (1888) p. 262; Fauna Brit. Ind., Mamm. pt. ii. (1891) p. 277).

Measurements of Rh. gracilis, subbadius, *and* monoceros.

	Rh. gracilis.	*Rh. subbadius.*	*Rh. monoceros.*
	♀ ad. Type.	♂ ad.	♀ juv. Type.
	mm.	mm.	mm.
Ears, length	15·7	14·5	...
„ greatest breadth	11	11·2	...
Nose-leaves, total length	11·2	10	...
„ breadth of horse-shoe	6·2	5·5	6·5
Forearm	36·2	34·2	38·2
3rd metacarpal	25	24·8	...
III.1	9·7	9·8	11·2
III.2	12	11·8	...
4th metacarpal	26·5	25	...
IV.1	7·7	7·2	8·8
IV.2	8·8	8·7	...
5th metacarpal	26·5	25	...
V.1	8·3	7·8	9·2
V.2	9·2	8·7	...
Tail	13·5	14	17·8
Lower leg	14·8	14·3	16·5
Foot	8	7·8	..
Skull, total length	15·7	...	...
„ mastoid width	7·7	..	.
„ width of brain-case	7	..	.
„ zygomatic width	7·7	...	
„ supraorbital length	4·2	...	...
„ width of nasal swellings	4·2	4	...
Mandible, length	10	10·2	...
Upper teeth	6	6	...
Lower teeth	6·3	6·2	...

23. Rhinolophus acuminatus Peters.

Diagnosis. Connecting process of the *lepidus*-type. Sella parallel-margined. Forearm 47–51 mm.

Details. This species, together with *Rh. sumatranus* and *calypso* described below, form a small, well-marked section of the *lepidus* group, which might conveniently be termed the *acuminatus* section, confined to Java, Lombok, Sumatra, and Engano, and differing from all the foregoing species:—(1) in being very much larger; *Rh. lepidus* is in size like a *Rh. hipposiderus*; *Rh. sumatranus* like a small *Rh. ferrum-equinum*; (2) in being *a trifle* more advanced in dentition: there seems to be no "vacillation" in the position of p_3.

Sella in *Rh. acuminatus* practically parallel-margined; on very close examination an extremely faint indication of an expansion below the middle can be traced. Lancet strongly hastate.

The rest of the nose-leaves, the mental grooves, the ears, the wing-structure, the length of the tail, and the insertion of the plagiopatagium (on the ankle, or slightly above or below) as in *Rh. lepidus*.

Skull. Very much larger than in *lepidus*. There is no essential difference in the shape *.

Dentition (two skulls). p_3 external. p_2 and p_4 quite, or almost, in contact. p^2 in row; a minute cusp, pointing inwards.

Measurements. On p. 134.

Geographical races. There are two forms of *Rh. acuminatus*, differing in size and in geographical habitat.

23 *a*. Rhinolophus acuminatus Peters, typicus.

Rhinolophus acuminatus Peters, MB. Akad. Berlin, 1871, p. 308; Dobson, Cat. Chir. Brit. Mus. (1878) p. 113.

Rhinolophus petersi (partim, nec Dobson 1872 et 1880) Dobson, op. cit. (1878) p. 114.

Diagnosis. Larger: forearm 50·5–51 mm.

Colour.—(1) Dark phase: ♂ ad., skin; teeth unworn. As *Rh. refulgens*.

(2) Russet phase: ♀ ad., in alcohol, unfaded; teeth unworn. "Cinnamon-rufous" above; base of hairs of the same colour; under side lighter.

Distribution. Java.

23 *b*. Rhinolophus acuminatus audax, subsp. n.

Diagnosis. Smaller: forearm 47–49·5 mm.

Colour. Two adult females, in alcohol, unfaded; teeth unworn, or worn. As *Rh. refulgens*.

Type. ♀ ad. (in alcohol). Lombok. Collected by A. Everett, Esq. Brit. Mus. no. 97.4.18.16.

Remarks. This form ought perhaps to be separated specifically from *Rh. acuminatus*. The mandible is markedly shorter, the teeth a trifle smaller, the nasal swellings slightly narrower, the geographical habitat quite isolated from that of *Rh. acuminatus*. But the Bali form, still unknown, may perhaps connect them together.

24. Rhinolophus sumatranus, sp. n.

Rhinolophus petersi (non Dobson 1872 et 1878) Dobson, P. Z. S. 1880, p. 462 (specimen examined).

Diagnosis. *Acuminatus* section, but sella very distinctly expanded below the middle. Width of horse-shoe 8·3 mm. Forearm 51–51·2 mm.

Details. Chief characters:—(1) compared with *acuminatus*: the very different shape of the sella, as described above; width at base, at expansion, and at summit: 2, 2·4, and 1·7 mm.; (2) compared with *calypso*: the much narrower horse-shoe.

Colour. ♂ ad., in alcohol, unfaded; teeth unworn. Upper

* The skull of the species of the *acuminatus* section is much like that of *Rh. rouxi*. It can, however, always be discriminated by the broader nasal swellings. The mandible is, proportionately, longer.

side darker than "mars-brown," lighter than "burnt-umber"; base of hairs scarcely differing in colour; under side "russet." This looks like an intermediate stage between a "dark phase" and a "russet phase." A second specimen (Göttingen Museum) is, however, quite of the same colour.

Skull. As in *Rh. acuminatus.*

Dentition (one skull). p_3 external. p_2 and p_4 quite in contact. p^2 in row; a minute cusp, pointing inwards. The interspace between the upper canine and p^4 is narrower than in *acuminatus.*

Measurements. Below.

Type. ♂ ad. (in alcohol). Lower Langkat, Sumatra; 1898. Presented by Herr Gustav Schneider. Brit. Mus. no. 4.4.1.1.

25. Rhinolophus calypso, sp. n. (Plate IV. fig. 19 *a*, *b*, *c*.)

Rhinolophus affinis (non Horsf.) Thomas, Ann. Mus. Civ. Genova (2) xiv. (1894) p. 108.

Diagnosis. Similar to *Rh. sumatranus*, but horse-shoe much broader: 10·2 mm.; ears longer and much broader. Forearm 52–52·3 mm.

Measurements of Rh. acuminatus, sumatranus, *and* calypso.

	Rh. acuminatus.				*Rh. sumatranus.*		*Rh. calypso.*	
	f. *typica.* 2 specimens, 1 skull.		*audax.* 2 specimens, 1 skull.		2 specimens, 1 skull.		2 specimens, 1 skull.	
	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.	Min. mm.	Max. mm.
Ears, length	18·5	...	18	19	18·7	19	19·5	21·5
„ greatest breadth	14	...	14	14·5	14·3	14·3	16·3	16·8
Nose-leaves, total length	14	...	14	14·8	14	16	16	16·8
„ breadth of horse-shoe	8·2	...	8·1	8·2	8·2	8·3	10·2	10·2
Forearm	50·5	51	47	49·5	51	51·2	52	52·3
3rd metacarpal	35·8	36·5	33·7	35·2	35·2	36·8	37	38·3
III.1	16·2	16·2	15	15	15·2	16·3	15	15·8
III.2	19·8	20·7	17·5	20	20	21	20·9	21·5
4th metacarpal	37·4	38·7	35·1	38·3	37·2	38	38·2	39·3
IV.1	11·2	11·8	9·7	10·5	11	11·7	10·3	10·8
IV.2	13	...	12	13	13	13·6	12·8	13·8
5th metacarpal	37·7	38·7	36	38·8	37·5	38·3	38·2	39·3
V.1	12·6	12·8	11·5	11·8	12·2	12·7	11·8	11·8
V.2	13·6	...	13	13·5	13·7	14·6	12·8	13·8
Tail	25	...	21·7	23·5	25·2	26·5	24·7	26·5
Lower leg	22·2	23	21	21·7	22·5	22·5	22·5	23·2
Foot	11·8		10·8	11	10·8	11	10·3	11
Skull, total length	.....			21·2	.....		21·6	...
„ mastoid width	.....			10	.....		10·2	...
„ width of brain-case	.....			9·3	.....		9·2	...
„ zygomatic width		11·4		11·2	.....		10·9	...
„ supraorbital length		5		5·3		5	5·4	...
„ width of nasal swellings		6·2		6		6·2	6·3	...
Mandible, length		16		14·8		15·8	15·2	...
Upper teeth		8·8		8·2		8·8	8·7	...
Lower teeth		9·5		9		9·5	9·2	...

Colour. ♂ ad. and ♀ ad., in alcohol, unfaded; teeth unworn. As *Rh. refulgens.*

Skull. As in *Rh. sumatranus*, but maxillar width, across the antero-external corners of m^3, narrower (8·1 mm., as against 8·6 in *Rh. sumatranus*).

Dentition. Essentially as in *Rh. sumatranus*, but the interspace between the upper canine and p^4 broader; p_2 and p_1 not quite in contact.

Type. ♂ ad. (in alcohol). Kifa Juc, Engano. Collected by Dr. E. Modigliani. Presented by Marquis G. Doria. Brit. Mus. no. 94.1.7.3.

General Remarks on the Rhinolophus lepidus *Group.*

The ancestral species.—The ancestors of the *simplex* and *lepidus* groups were very closely related. The latter had a projecting connecting process, a slightly smaller skull and teeth. But the general *shape of the skull*, the *dentition*, the nose-leaves, apart from the process and a very slight difference in the shape of the sella, the ears, the *wing-structure*, the length of the tail, and, we might even say, probably the size, were either identical or extremely similar in both of these extinct Bats.

The place of origin.—There can scarcely be any doubt that the *lepidus* group originated much farther westwards than the *simplex* group. If we regard Japan as a continental group of islands, and put aside Java, on account of its peculiar geological history, we still find, not only the most primitive, but in fact *all* the species of the *lepidus* section on the Continent. It is only the *acuminatus* section which has spread over the adjacent larger islands, one of which (Sumatra) has comparatively recently been continental, while another (Java), probably in a more remote period, seems to have been connected with some part or other of Indo-China; and only one form, still so closely related to the Java species as hardly to be specifically different, has found its way so far eastwards as Lombok. The hypothesis, therefore, cannot be called unfounded, that *of the two ancestral species, the ancient* "simplex" *and the ancient* "lepidus," *the former was Eastern* in range (Austro-Indo-Malayan), *the latter Western* (Oriental).

*Differentiation**.—From a systematic point of view I found it convenient to divide the *lepidus* section into three "types"; I think that, phylogenetically speaking, there are two only: the *lepidus* and the *minor* type. The former, as coming nearest to *simplex* in the proportionate size of the skull and teeth, is, probably, the more primitive; it is now distributed over the Indian Peninsula (*lepidus*), the Himalayas (*monticola*), and Malacca (*refulgens*). The latter, the *minor*-type, has spread from the Himalayas (*minor*) eastwards through S. China to Japan (*cornutus*); it is represented on the now quite isolated Anambas Islands ("*minutus*"); its occurrence in Java is not surprising, considering

* Compare the diagram on p. 138.

the faunistic affinities of that island; and it has established itself on the western coast of the Indian Peninsula (*gracilis*). I have but very little doubt that now, when attention has been called to the differences of all these forms of the *minor*-type, it will be found also in other parts of the Indian Peninsula.

If any inference can be drawn from fragments of a skull and the external characters, the *subbadius*-type would appear to be an offshoot of the *minor*-type: already in *minor* and *cornutus* the process is a little sharper-pointed than in *lepidus*; in *subbadius* and *monoceros* this tendency is carried much further.

The skull of the species of the *acuminatus* section (Java–Lombok, Sumatra–Engano) is of the *lepidus*-type; the process too; the colour remarkably like that of *refulgens*. This leads me to suppose that *acuminatus* and its allies (*sumatranus*, *calypso*) are scarcely more than giant representatives of the *lepidus*-type.

It is the *subbadius*-type which, from a zoogeographical point of view, is by far the most interesting: it has spread southwestwards over a vast part of the Ethiopian Region, and westwards over the Mediterranean countries:—

(1) The *empusa*-type.—*Rh. empusa** and *blasii* have progressed further on the way already indicated by *Rh. subbadius*. They have the small skull and the small teeth characteristic of *minor-subbadius*; in the shape of the skull there is no essential difference; *the dentition is identically the same*; the process is that of a *subbadius*; *the sella is deltoid*, that is: the tendency, in the *subbadius*-sella (as emphasised above), towards assuming a subacute summit has been further developed; and we still see *the constriction at the middle of the sella*. But *empusa* and *blasii* are (as always the Ethiopian and W. Palæarctic species) in several points more highly developed: III.^{2} is lengthened (about, or more than, $1\frac{1}{2}$ the length of III^1.); also IV.^{2} is very much longer (not far from twice the length of IV^1.). *Rh. empusa* is, however, an inhabitant of Nyasa-land, far S. of the Equator, *Rh. blasii* of the Mediterranean Subregion; thus, the two extremely closely allied species are now separated by an enormous tract, where no relative appears to occur. As we now know that they are descendants of the Oriental *subbadius*-type, the explanation seems to be quite clear: one branch spread southwestwards, into the Ethiopian Region, and developed into *Rh. empusa* (slightly more primitive dentition; shorter ears, broader horse-shoe); another westwards into the Mediterranean countries, *Rh. blasii*. There is an instructive fact connected with these two Bats: I believe them to be comparatively recent intruders into their areas; *Rh. empusa* is known from one specimen only, from the very *East* of Tropical Africa; *Rh. blasii* is much more common in the *Eastern* Mediterranean tract, and still it does not seem to have reached Spain†.

* Andersen, Ann. & Mag. Nat. Hist. (7) xiv. (1904) p. 378 (there is a misprint on p. 380: the length of the mandible is 12·1, not 13·1 mm.).

† Not recorded in Cabrera Latorre's "Quirópteros de España," Mem. Soc. Españ. Hist. Nat. ii. (1904). I am also not satisfied that there is any reliable record from the African coast of the Mediterranean.

(2) The *landeri-euryale* type.—The Ethiopian *Rh. landeri* (Fernando Po, Gaboon), *Rh. lobatus* (Lower Zambesi to Mombasa), and *Rh. dobsoni** (Kordofan) have the small skull and the small teeth characteristic of *minor-subbadius*; the same shape of the skull; *the same dentition* (no vacillation in the position of p_3); the process is that of a *subbadius*. In so far there is no difference at all between this section and the former (*empusa-blasii*). But in the shape of the sella and in a certain peculiarity in the wing-structure they have taken a course of their own:—We have seen, in the *simplex* group, a progressive development from a sella constricted at the middle, through a parallel-margined stage, to a pandurate sella; we have seen in the *lepidus* group, too, the constricted sella (*minor*) modified into the parallel-margined (*gracilis*); *the Ethiopian species* here under consideration *represent the* third and *final stage, the pandurate sella.* In addition to this: in all of them IV.[1] *is peculiarly shortened*: less than (extremely rarely, as a slight individual atavism, equal to) half the length of IV[2]. As in *Rh. empusa* and *blasii*, III.[2] is lengthened.

Rh. euryale, from the Mediterranean Subregion, is so extremely closely allied to the above-named Ethiopian species that it shares with them *all* essential characters (even *the highly peculiar shortening of* IV.[1]), with one exception: *it has retained the parallel-margined sella.*

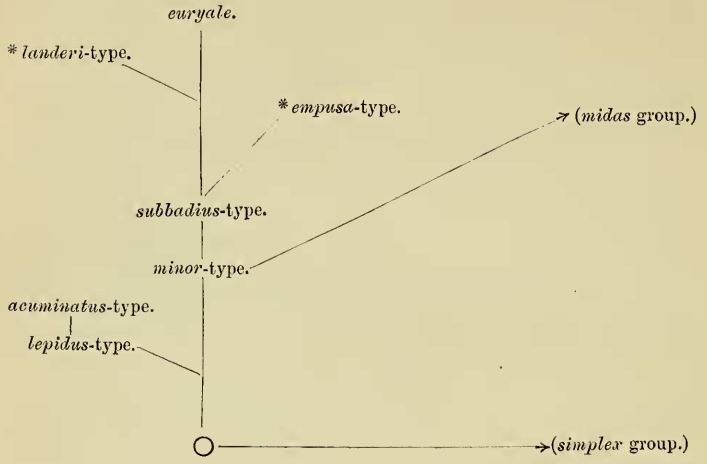
Summary.—When discussing the affinities of the Ethiopian species of the *Rh. simplex* group (above, pp. 117–20), I arrived at the conclusion that they are undoubtedly derived from Oriental types, and that, most probably, the ancestral species have spread directly from South Asia into the Ethiopian Region. As will be observed from this, a study of the Ethiopian representatives of the *Rh. lepidus* group leads to quite the same result: they have their closest known allies in the Oriental Region, but they are, without exception, considerably more highly developed than any of their Oriental relatives. Bats of the *subbadius*-type have evidently spread from some part of South Asia southwestwards into the Ethiopian Region (*empusa*; *landeri*, *lobatus*, *dobsoni*), and westwards over the Mediterranean countries (*blasii*; *euryale*). Of all the species of the *Rh. lepidus* group only one has found its way to Lower Egypt, *Rh. euryale*. It is a species exclusively Mediterranean in range, and unusually liable to differentiation into slightly differing local forms†. Its presence in Lower Egypt is easily explained by invasion from the adjacent Asiatic coast of the Mediterranean, where it is very common (specimens from Lower Egypt are indistinguishable from the Palestine form, *Rh. e. judaicus*)‡.

* Thomas, Ann. & Mag. Nat. Hist. (7) xiv. (1904) p. 156.

† Andersen and Matschie, "Ueber einige geographische Formen der Untergattung *Euryalus*" (SB. Ges. naturf. Fr. Berlin, 1904, pp. 71–83).

‡ Although it is beyond the strict limits of the present paper, I propose to insert a few words on the remaining Ethiopian species of the genus:—The *æthiops* section (*Rh. æthiops, hildebrandti*, and *fumigatus*) are very closely related to the Himalayan *Rh. macrotis*, but much more highly developed in the dentition, the wing-

The probable affinities and phylogeny of the principal forms of the *Rh. lepidus* group are expressed in the subjoined diagram (Ethiopian types marked with an asterisk) :—



III. The *Rhinolophus midas* Group.

Diagnosis. Cochleæ large, making the basioccipital, between them, extremely narrow (linear). Posterior connecting process very low and rounded off.

26. Rhinolophus midas, sp. n. (Plate IV. fig. 20 *a*, *b*, *c*, *d*.)

Diagnosis. Sella almost deltoid, summit rounded. Forearm 37·7 mm.

Details. Horse-shoe as broad as the upper lip; no "tooth" on the sides of the median notch; no crenulation of the border. Lateral margins of sella converging from base to tip; breadth at base (2·3 mm.) much more than half the vertical height of the sella (3·5 mm.); a very slight (rather easily overlooked) constriction at the middle; summit rounded (breadth 1·6 mm.). Connecting process very low, and broadly rounded off. Lancet long (4 mm.) and cuneate. One mental groove only.

Ears a little longer than in *minor*, outer margin immediately below the tip somewhat more emarginate; tip more distinctly pointed.

Wing-structure, compared with that of *minor*, considerably

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structure, and the mental grooves (Andersen, Ann. & Mag. Nat. Hist. (7) xvi. Sept. 1905, pp. 291–92). *Rh. maclaudi* is an Ethiopian representative of the *Rh. philippinensis* group, but on a considerably higher stage of development in the same respects as the species just named (*Id.*, *tom. cit.* Aug. 1905, pp. 254–55).

This completes the account, showing that *all the Ethiopian Rhinolophi*, without exception, *are of Oriental origin.*

modified, chiefly in two respects:—(1) *the third metacarpal is shortened*; but at the same time the fourth metacarpal has remained the longest (as in all primitive species of *Rhinolophus*); (2) III.^{2}, IV.^{2}, and V.^{2}, that is all the distal phalanges, are lengthened. Compare the table of measurements of *Rh. midas* and *hipposiderus* on the one side, with those of *minor*, *lepidus*, and all their allies on the other (see p. 143).

Tail rather long, $1\frac{1}{2}$ the length of the leg. Plagiopatagium inserted on the ankle-joint.

Colour (somewhat faded in alcohol) probably as light as in *Rh. blasii*.

Skull. In all species of *Rhinolophus* the cochleæ are large, making a narrow basioccipital (compare the genus *Hipposiderus*); but in *Rh. midas* and *hipposiderus* the peculiarity is carried to an extreme: *the cochleæ are so much increased in size as to reduce the basioccipital to a linear bridge of bone*; in some individuals (of *Rh. hipposiderus*) the cochleæ are *almost* in contact. This character alone makes the skull of these two species easily distinguishable, at a glance. But in every other respect, in the shape, the size, and the teeth, the skull is so exceedingly like that of *Rh. minor*, that there can scarcely be any doubt as to the very close relationship of the *minor* and *midas* types.

Dentition. On the *minor* stage:—p_3 external. A very narrow interspace between p_2 and p_4. p^2 quite in row; a small cusp, pointing inwards. Upper canine and p^4 well separated.

Type. ♀ ad. (in alcohol). Jask, Persian Gulf. Presented by A. Butcher, Esq. Brit. Mus. no. 94.11.16.1.

Remarks. The discovery of this highly interesting species seems to remove all doubt as to the close affinities of *minor* and *hipposiderus*. The sella of *midas* is intermediate between that of *minor* and *hipposiderus*; it recalls that of *empusa* and *blasii*, which also are modifications of the *minor*-type; to the peculiarly long and cuneate lancet we have a parallel in one of the modifications of the *minor*-type described in this paper, viz. *Rh. gracilis*. The geographical habitat of *midas* is, too, rather intermediate between the Oriental *minor* and the W. Palæarctic *hipposiderus*.

Rh. midas is, of course, readily distinguishable from *Rh. hipposiderus* by the shape of the sella. In the width of the brain-case, as well as in external dimensions, it is like the *southern*, more primitive form of *hipposiderus* (*Rh. h. minimus*).

27. Rhinolophus hipposiderus Bechst.

Diagnosis. Sella cuneate; summit pointed. Forearm 34·7–41·7 mm.

Details. Breadth of sella at base never more, but generally less, than half its vertical height.

Colour. (1) Younger, but quite full-grown individuals; skins; Cyprus, S. Carpathians, Switzerland. Very nearly "mouse-grey" above; horse-shoe patch faintly, or not at all, indicated; base

of hairs of the upper side and the whole of the under side "drab-grey."

(2) Aged individuals; skins; Cyprus, Malta, Balearic Islands, Switzerland, Germany. Much browner. General colour above brownish "drab," with some individual variation in the shade of the colour: sometimes almost "wood-brown" (lightest extreme), sometimes with a tinge of "Prout's brown" (darkest extreme); horse-shoe patch indicated, or quite obliterated; base of hairs "ecru-drab"; under side "ecru-drab," sometimes with a tendency towards "drab-grey."

Skull. As in *Rh. midas.*

Dentition. As in *minor* and *midas.* In the series of skulls examined (20; of all races) there is, of course, some variation in the position of p_3; the general rule is: p_3 external, p_2 and p_4 almost or quite in contact; one extreme: p_3 *almost* in row (one skull), and p_2 and p_4, therefore, well separated; the other extreme: p_3 not only external, but hair-fine (four skulls; teeth unworn), or disappeared and the alveoli obliterated (two skulls; teeth unworn).

Distribution. From Gilgit to Ireland; from the Baltic to Sennar.

Geographical races. The series examined—95 examples, from almost the whole area occupied by the species—enables me to recognise three races of *Rh. hipposiderus.* The first two of these would probably be called distinct species by other zoologists.

27 *a.* Rhinolophus hipposiderus minimus Heugl.

Rhinolophus minimus Heuglin, N. Act. Acad. Cæs. Leop.-Car. xxix. (1861) p. 6.

Rhinolophus hipposiderus minimus Andersen, Ann. & Mag. Nat. Hist. (7) xiv. (1904) p. 455.

Diagnosis. Small: forearm 34·7–38 mm.

Details. As lately pointed out by me elsewhere (*l. s. c.*), v. Heuglin's *Rh. minimus*, first described from Keren in Erythrea (type in the Stuttgart Museum), is a well-marked geographical race of *Rh. hipposiderus*, differing from the Central European form by its considerably smaller size. At the same time I mentioned that the British Museum possesses an example from Sennar indistinguishable from the type specimen of *minimus.* A subsequent examination of the whole series of *Rh. hipposiderus* preserved in the British Museum has revealed the rather surprising fact that *Rh. h. minimus* is by no means confined to Keren and Sennar, but *generally distributed over the Mediterranean Subregion.*

It differs from the Central European form in being *in every respect smaller*; in some respects, as it seems, *absolutely* smaller, in others at least on an average. I find the length of the forearm to be the best means for a ready discrimination: in *minimus*, 34·7–38 mm.; in the typical form, 39–41·7 mm. For other details, *cf.* the measurements on p. 143.

The skull is markedly smaller, the nasal swellings a trifle narrower, the teeth slightly smaller.

Distribution. 32 specimens examined. As it is of some interest to have the range of this hitherto overlooked form exactly determined, I subjoin a list of the localities from which I have seen examples, together with measurements of the forearm; it might perhaps lead to further investigation:—

Keren (1, the type *): forearm 36·3. Sennar (1): 36·5. Cyprus (6): 34·7–37·7. Smyrna (1): 37·5. Malta (8): 36–37. Middle Italy (Ostia 2): 35·7–36·8. Corsica (1): 37·7. Haute Savoie and Geneva (2): 37·7–38. Balearic Islands (7): 36·2–37·6. Seville † (1): 37·7. Morocco (Tangiers 1): 37·7. Portugal (Cintra 1): 36·2.

Summary of Distribution:—The Mediterranean Subregion, southeastwards to Sennar and Keren. Be it noted: there is no record from Egypt (and, very likely, it does not occur there: *cf.* remarks on p. 143).

Remarks. In the whole series of *Rh. hipposiderus* examined (apart from the British specimens, of course) I have not found any individual which I could not easily refer either to the southern or the northern form. I have some reason to believe that in certain *border districts* (*e. g.* S.W. Switzerland; *perhaps* also Cyprus) the two forms *occur together*, perhaps side by side, but *intermediate examples* I have never seen. They will probably be found.

27 *b*. Rhinolophus hipposiderus Bechst., typicus.

Vespertilio Ferrum equinum (partim) Schreber, Säugthiere, i. (1775) pp. 174, 188, pl. 62 (lower fig. only).

Vespertilio equinus (partim) P. L. S. Müller, Natursyst., Suppl. (1776) p. 20.

Vespertilio Ferrum equinum, *β. minor*, Gmelin, Linn. Syst. Nat. i. (1788) p. 50.

Vespertilio Hippocrepis (partim) Schrank, Fauna Boica, i. (1798) p. 64.

Vespertilio Hipposideros Bechstein, in Pennant's Allg. Uebers. vierfüss. Thiere, ii. (1800) p. 629, footnote (compare also pp. 615 and 736).

Vespertilio hippocrepis Hermann, Obs. Zool. (1804) p. 18.

Rhinolophus bi-hastatus Geoffroy St.-Hilaire, Descr. de l'Égypte, ii. (1812) p. 132; id., Ann. Mus. d'Hist. Nat. xx. (1813) p. 259, pl. 5.

* For the loan of this specimen I am indebted to Prof. Dr. Kurt Lampert, Director of the Royal Natural History Cabinet, Stuttgart. The type is a young, but apparently fullgrown, individual. *All* other examples of *hipposiderus*, of all races, of which I give the measurements, are fully adult (distal epiphyses of metacarpals ossified).

† As I have seen only one example from Spain, I may mention that of the whole series examined by Cabrera Latorre, for his "Quirópteros de España," no Spanish specimen had the forearm *more* than 37·5 mm. (Mem. Soc. Españ. Hist. Nat. ii. (1904) p. 252). I am unacquainted with the *Rh. phasma* (allied to *hipposiderus*) described by Cabrera in the same paper.

Rhinolophus Hipposideros var. *typus*, *alpinus*, et *pallidus* (partim) Koch, Jahrb. Ver. Naturk. Nassau (1862–63) pp. 530–31 *.

Rhinolophus hipposideros (partim) Peters, MB. Akad. Berlin, 1871, p. 310; Dobson, Cat. Chir. Brit. Mus. (1878) p. 117.

Rhinolophus bihastatus var. *Kisnyiresiensis* Daday, Orvos-Term. Értes. x. pt. 3 (1885) p. 274.

Rhinolophus hipposideros var. *troglophilus* Daday, Magy. tud. Akad. Értekez. xvi. pt. 7 (1886) p. 8, figs. 1, 2.

Rhinolophus euryale helvetica Bretscher, Vierteljahrsschr. naturf. Ges. Zürich, xlix. (1904) p. 256 †.

Diagnosis. Large: forearm 39–41·7 mm.

Distribution. 33 specimens have been examined, from the following localities:—

Gilgit (1): forearm 39·8. Urmi, N.W. Persia (1): 39·8. Van, Armenia (2): 39·2–39·3. Cyprus (1): 39·6‡. N. Bulgaria (1): 39. Roumania (13): 39–41·2. Transsylvania (2): 40–41. S. Carpathians (1): 39·3. Hungary (1): 41·7. Schlangenbad (2): 40–40·1. Strassbourg (3): 39–40·1. Thurgau and Vallais (5): 40·2–41·7.

Summary of Distribution:—From the extreme N.W. Himalayas, through N.W. Persia and Armenia, over the whole of Central Europe N. of the Balkans and the Alps.

27*c*. Rhinolophus hipposiderus minutus Montagu.

Vespertilio minutus Montagu, Trans. Linn. Soc. ix. (1808) p. 162, pl. 18. figs. 7–8.

Diagnosis. Forearm 36·3–39 mm.

Details. English and Irish individuals of *Rh. hipposiderus* differ from the Central European form in being on an average (and nearly always also *absolutely*) smaller. The length of the forearm varies, in 30 adult specimens from England, Wales and Ireland, between 36·3 and 39 mm., the average being 37·6. In other words: *the average size of the British race is considerably below the minimum of the typical form, and almost exactly like maximum of* Rh. h. minimus.

Distribution. England, Wales, Ireland §.

Technical name. Till the close of the 18th century, the two Bats now called *Rh. ferrum-equinum* and *Rh. hipposiderus* were

* Koch's "varieties" are scarcely determinable, his descriptions being utterly vague and based upon such characters as are subject to individual variation or dependent on age; var. *typus* and *alpinus* belong, probably, to the Central European form; var. *pallidus* seems to be a mixture of this and the southern race.

† A glance at the measurements in Bretscher's paper is sufficient to show that what he takes to be "eine ausgesprochene Lokalform" of *Rh. euryale* is an ordinary, typical *Rh. hipposiderus*!

‡ I ought perhaps to mention that this example, the only *typical hipposiderus* I have seen from Cyprus, is a dealer's specimen; a Cyprus series collected and presented by Miss Dorothy M. A. Bate (*cf.* P. Z. S. 1903, ii. p. 342) are unquestionably of the Mediterranean form.

§ For details, *cf.* J. E. Kelsall, "The Distribution in Great Britain of the Lesser Horse-shoe Bat," The Zoologist, xlv. (1887) p. 89.

regarded as a large and a small variety of one species. In 1808, Montagu pointed out some of their distinctive characters, and proposed for the smaller species the name *Vespertilio minutus*, being evidently unaware that the two Bats had already twice been specifically separated—by Bechstein in 1800, and by Hermann in 1804. Montagu's name, as being antedated by "*hipposiderus*," was soon almost completely forgotten (it is not recorded in Dobson's Catalogue). The original description of *V. minutus* being, however, based on English specimens, the name is now available for the British race of *hipposiderus*.

Remarks. We are now able to form a much clearer idea of the past history of *Rh. hipposiderus*. It originated from a Bat allied to *Rh. minor*, somewhere in Asia, most probably near the western border of (if not within) what is now called the Oriental Region. From there it spread southwestwards into Africa, westwards through the Mediterranean countries to Central Europe and the British Islands. There is, to my knowledge, no record of *Rh. hipposiderus* from Egypt; if this is evidence that it does not occur, and has not occurred, there, it is at the same time a

Measurements of Rh. midas *and* hipposiderus.

	Rh. midas.	*Rh. hipposiderus.*					
	♂ ad. Type.	*minimus.* 32 specimens, 12 skulls.		f. *typica.* 33 specimens, 6 skulls.		*minutus.* 30 specimens, 2 skulls.	
		Min.	Max.	Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Ears, length	17	14	16	15	16·5	14·2	15·5
„ greatest breadth	13	10	12	11·3	12·8	11·1	11·8
Nose-leaves, total length	12·8	10·6	12	11·2	12·9	10	11·8
„ breadth of horse-shoe	7·3	6	6·8	6·5	7	6	6·7
Forearm	37·7	34·7	38	39	41·7	36·3	39
3rd metacarpal	24·2	22·2	25·7	24·8	27·3	22·8	24·9
III.[1]	11·8	11	12·8	12·7	14·2	11·6	13·2
III.[2]	18·8	15·7	19	17·7	19·7	16·3	18·7
4th metacarpal	27	25	29·2	28	30·2	25·7	29·1
IV.[1]	7·1	5·8	7·8	7	8	6·7	8
IV.[2]	12	10·9	13·2	12	14·1	11·7	13·2
5th metacarpal	25·8	23·5	27·7	27·2	29·7	24·7	28·2
V.[1]	8·9	7·9	9·2	9·1	10·5	7·2	9·8
V.[2]	12·2	11·2	13·8	12·8	14·3	12·5	14·3
Tail	24·5	23·5	27·7	26·2	30·3	23·5	27
Lower leg	16·2	16	17·8	17·8	19·9	16·3	18·5
Foot	7·6	7·2	7·8	7·5	8·5	7·5	8·7
Skull, total length	15·9	14·5	15·5	16	16·2	16	16
„ mastoid width	7·4	7·2	7·7	7·7	7·8	7·8	7·8
„ width of brain-case	6·4	6·1	6·5	6·8	6·8	6·8	6·8
„ zygomatic width	7·6	7·2	7·9	7·8	8	8	8
„ maxillar width	5·8	5·2	5·3	5·3	5·5	5·6	5·7
„ supraorbital length	4·5	4	4·5	4·2	5	4·3	4·4
„ width of nasal swellings	4·2	3·7	3·8	3·9	4	4	4
Mandible, length	10·8	9·5	10	10	10·2	...	10·2
Upper teeth	5·8	5·2	5·4	5·4	5·7	5·7	5·7
Lower teeth	6·2	5·6	5·8	5·8	6	5·9	6

proof that it did not reach Erythrea and Sennar from the Mediterranean, by way of the Nile Valley, but *via* the formerly existing, broad land-connection between S.W. Asia and N.E. Africa. The individuals which established themselves in Central Europe, N. of the Balkans and the Alps, gradually making their way as far north as the Baltic, developed into a distinct, larger race (*Rh. h. typicus*). The British colony, originally the extreme western offshoot of the larger form, but soon cut off from communication with the Continental main stem, also developed into a distinct race (*Rh. h. minutus*); it got the not unusual stamp of an island form: the smaller size; and so it came to occupy, *seemingly*, but neither phylogenetically nor geographically, a somewhat intermediate position between the northern and southern races of *hipposiderus*, between its immediate and its more remote progenitors.

It is worth noticing that *Rh. hipposiderus* is distributed over the whole of England, occurring also in several places in Ireland, whereas *Rh. ferrum-equinum* is confined to the extreme south of England, apparently not farther north than Essex, Gloucester, and Pembroke, and has never reached Ireland. It may indicate that of these two comparatively recent immigrants into the British Islands, *Rh. hipposiderus* was the earlier comer. This assumption seems strengthened by another fact. On the Continent *Rh. hipposiderus* goes farther northwards and considerably higher up on the mountains than *ferrum-equinum*. It is but reasonable to suppose that the more hardy species was also the first to make its way to England.

IV. Summary.

1. A progressive evolution is pointed out from the Austro-Malayan *Rh. simplex*, through a long series of Oriental forms, to the Western Palæarctic *Rh. ferrum-equinum* (pp. 76–120; *résumé* pp. 116–120).

2. A similar chain from the Oriental *Rh. lepidus* to the Western Palæarctic *Rh. blasii* and *Rh. euryale* (pp. 123–138; *résumé* pp. 135–138).

3. The Western Palæarctic *Rh. hipposiderus* has no closer known relative than *Rh. midas* from the coast of the Persian Gulf, which again can be traced back to the Oriental *Rh. minor* (pp. 138–144).

4. All the Ethiopian representatives of the genus *Rhinolophus* are of Oriental origin (pp. 117–120, 136–138).

5. The following 26 forms (14 species and 12 subspecies) are described as new, all of them Austro-Malayan, Oriental, or Asiatic-Palæarctic:—*Rh. simplex*, p. 76; *megaphyllus monachus*, p. 80; *nanus*, p. 82; *celebensis*, p. 83; *virgo*, p. 88; *nereis*, p. 90; *stheno*, p. 91; *rouxi sinicus*, p. 98; *thomasi*, p. 100; *affinis himalayanus*, p. 103; *a. tener*, p. 103; *a. macrurus*, p. 103; *a. superans*, p. 104; *a. nesites*, p. 104; *a. princeps*, p. 106; *ferrum-*

equinum regulus, p. 112; *f. proximus*, p. 112; *monticola*, p. 124; *refulgens*, p. 124; *cornutus pumilus*, p. 127; *gracilis*, p. 129; *monoceros*, p. 131; *acuminatus audax*, p. 133; *sumatranus*, p. 133; *calypso*, p. 134; *midas*, p. 138.

6. The following 10 forms, hitherto usually regarded as identical with other species, are shown to be distinct species or subspecies:—*Rh. truncatus* Peters, p. 80; *borneensis* Peters, p. 84; *rouxi* Temm., p. 93; (*ferrum-equinum*) *nippon* Temm., p. 110; (*f.*) *tragatus* Hodgs., p. 111; *lepidus* Blyth, p. 123; *cornutus* Temm., p. 127; *subbadius* Blyth, p. 129; (*hipposiderus*) *minimus* Heugl., p. 140; (*h.*) *minutus* Mont., p. 142.

7. The following names, hitherto usually regarded as indicative of distinct species, are referred to the lists of synonyms:—*Rh. petersi* Dobson, p. 95; *garoënsis* Dobson, p. 131.

EXPLANATION OF THE PLATES.

Plate III.

Rhinolophus simplex group; skulls; front views $\frac{2}{1}$, all other figures $\frac{1}{1}$.

Fig. 1. *Rh. simplex* (p. 76); Lombok; type of the species. Front view.
2 *a, b, c. Rh. megaphyllus* f. *typica* (p. 79); Cooktown; B.M. no. 3.8.3.3. Upper, lateral, and front views.
3. *Rh. nanus* (p. 82); Goram; type. Front view.
4 *a, b. Rh. celebensis* (p. 83); Makassar; type. Upper and front views.
5 *a, b, c. Rh. borneensis* f. *typica* (p. 84); Labuan; topotype; B.M. no. 65.5.9.15. Upper, lateral, and front views.
6. *Rh. malayanus* (p. 89); Biserat; topotype; B.M. no. 3.2.6.84. Front view.
7 *a, b, c. Rh. nereis* (p. 90); Siantan, Anambas; type. Upper, lateral, and front views.
8 *a, b. Rh. stheno* (p. 91); Selangor; topotype; B.M. no. 98.3.13.2. Lateral and front views.
9 *a, b, c, d. Rh. rouxi* f. *typica* (p. 93); Ceylon. Upper, lower, lateral, and front views.
10. *Rh. thomasi* (p. 100); Taho, Karin Hills; topotype; B.M. no. 90.4.7.9. Upper view.
11 *a, b. Rh. affinis himalayanus* (p. 103); Nepal. Lower and front views.
12. *Rh. a. tener* (p. 103); Pegu; type. Upper view.
13. *Rh. a. princeps* (p. 106); Lombok; type. Upper view.

Plate IV.

Rhinolophus simplex, *lepidus*, and *midas* groups; skulls; front views $\frac{2}{1}$, all other figures $\frac{1}{1}$.

Fig. 14 *a, b, c, d. Rh. ferrum-equinum tragatus* (p. 111); Nepal; one of the cotypes. Upper, lower, lateral, and front views.
15. *Rh. f. proximus* (p. 112); Gilgit; type. Upper view.
16 *a, b, c. Rh. refulgens* (p. 124); Perak; type. Upper, lateral, and front views.
17 *a, b, c. Rh. cornutus pumilus* (p. 127); Loo-choo Isl.; topotype; B.M. no. 2.10.7.2. Upper, lateral, and front views.
18 *a, b, c. Rh. gracilis* (p. 129); Malabar coast; type. Upper, lateral, and front views.
19 *a, b, c. Rh. calypso* (p. 134); Engano; type. Upper, lateral, and front views.
20 *a, b, c, d. Rh. midas* (p. 138); Jask, Persia; type. Upper, lower, lateral, and front views.